amateur radio

MARCH, 1972

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JOURNAL OF THE WIRELESS INSTITUTE OF AUSTRALIA

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MODEL OL-64D MULTIMETER

20,000 ohms per volt. DC volts: 0.025, 1, 10, 50, 250, 500, 1000 (at 20K o.p.v.), 5000 (at 10K o.p.v.). AC volts: 0-10, 50, 250, 1000 (at 8K o.p.v.). DC current: 50 uA., 1 mA., 50 mA., 500 mA., 10 amps. Resistance: 0-4K, 400K, 4M, 40 megohms. DB. scale —20 to plus 36 dB. Capacitance: 250 pF. to 0.02 uF. Inductance: 0-5000 H. Size: 5¾ x 4⅛ x 1¾ in.

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100,000 ohms per volt DC. Mirror scale, protected movement. DC volts: 3, 12, 60, 120, 300, 600, 1200 (100K o.p.v.). AC volts: 6, 20, 120, 300, 600, 1200 (10K o.p.v.). DC current: 12 uA., 6 mA., 60 mA., 300 mA., 12 amps. Resistance: 2K, 200K, 20M, 200 megohm. Decibels: —20 to plus 63 dB. Audio output: 6, 30, 120, 300, 600, 1200 volts a.c. Size: 7½ x 5½ x 2¾ inch.

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Price $199.50 net.

LAFAYETTE HA800, solid state, as above but **Ham Band only**. SSB-AM-CW. **Price $195** net.

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amateur radio

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Hamads should be addressed to the Manager by the **third of each month.**

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★

ACKNOWLEDGMENTS: No acknowledgments are sent out unless specially requested. Better still, for important items, send them by certified mail.

★

NON-RECEIPT OF "A.R.": Members of W.I.A. please inform your Divisional Secretary—others, please address the Manager. Unavoidable communications and processing delays can be alleviated only if adequate notice is given of address changes. Do not forget to inform the P.M.G. of address changes.

CONTENTS

COVER STORY

Close up of VK3ABM's call on SSTV from Melbourne. Photograph taken from his monitor. Note the good use of the Kangaroo.

QSP

UNDER NEW MANAGEMENT

This issue of "Amateur Radio" is the first published by the Federal body. For the first time the magazine becomes the direct responsibility of not just one Division but the responsibility of all Divisions. The ultimate decision as to its content, cost, and format will be made by the Federal Council. Any profit becomes the profit of all the Divisions, but on the other hand, if the production of the magazine results in a loss, this loss is borne by the Divisions in the sense that they together constitute the Wireless Institute of Australia. This is as it should be.

I am pleased to tell you that Bill Roper, VK3ARZ, is now able to again assist the Institute; he has become the Editor, and as such is a member of the Executive and Chairman of the Publications Committee. His task is to co-ordinate the activities of the many people who contribute to the production of the magazine. He is supported by an experienced and enthusiastic committee as well as by Peter Dodd who is the Manager of the magazine and as such will devote a very substantial part of his time to publications.

We should be careful not to underrate the importance of "Amateur Radio". A good magazine is one of the tangible benefits of membership of the Institute. A poor magazine will hardly attract new members. Equally, "Amateur Radio" is the medium by which the Institute can inform all of its members, Australia wide, of what it is doing and why. Remember, also, that many people who are not members, read our publication, both in Australia and overseas. Some may become members; some may learn a little of Amateur Radio, some may learn more of the Institute.

Over recent months I am aware of a number of criticisms levelled against the magazine. A number of factors have contributed to justify some of that criticism. The resignation of Ken Pincott as Editor and the fact that this occurred some months prior to the transfer of the magazine to the Federal body is one factor. That "in between" period has now passed. Another factor restricting the expansion of the magazine has been the problem of ever rising costs, including postage costs. A third, and equally serious factor, has been the "fall off" of advertising and therefore revenue. Therefore the newly re-constituted committee faces a period of intense effort in trying to overcome these problems as well as incorporating publications as part of a new administrative system, and, at the same time, trying to improve the magazine. You will note in this issue, for example, the first of a number of changes. I hope you think they are for the better. Please don't hesitate to write to the Editor if you have any suggestions.

You may ask "Is there anything I can do apart from the submission of material for publication?" There is. I have referred to the loss of advertising revenue. We need more advertising. We must re-assure those that already advertise that they are getting value for money. By letting advertisers know that you buy their products as a result of their advertising in "Amateur Radio," and perhaps if you are in a position to do so, by encouraging new advertisers to come to the magazine you will be helping the Institute in a vital way, and at the same time be contributing to one of the Institute's services that is received by all members.

MICHAEL J. OWEN, VK3KI,
Federal President, W.I.A.

END OF AN ERA

As the President has said, this issue marks the end of one era and the start of the next. For almost 40 years "A.R." has been produced and published, on behalf of the Institute as a whole, by the Victorian Division. The work now has been passed to the Executive of the Institute following upon the Incorporation of "The Wireless Institute of Australia" and agreements between the Federal Council, the Executive and the VK3 Division.

PROJECT AUSTRALIS

A fully-tested single-channel satellite translator unit to assist with experimental work in Divisions was received and has been allocated initially to the VK5 Division until Easter. It is then intended to transfer it to the VK4 Division. The frequencies are 145.8 MHz. in, 435.1 MHz. out, input 12-15v. at 400 mA.; output 1w. or better into 52-75 ohm co-ax.

THE EXECUTIVE

At the first formal meeting of the Executive in terms of the new Company on 26th January those elected until the next Convention were Michael J. Owen, VK3KI, President and Chairman; David Rankin, VK3QV, as Vice-Chairman; W. E. J. (Bill) Roper, VK3ARZ, as Editor; Drs. David Wardlaw, VK3ADW, and James Goding, VK3DM, and W. A. (Bill) Faul, VK3AGZ. Peter B. Dodd, VK3CIF, was appointed Secretary. The official name of the new Company is "The Wireless Institute of Australia", the word "limited" being dropped by special licence. The new Company is a public company limited by guarantee and the Registered Office is 478 Victoria Parade, East Melbourne. During a transitional period the old unincorporated body with its "Federal Executive" and the new Company will operate in parallel.

TRANSLATORS/REPEATERS

An editorial by Bob Clark, WB4SMH, in Amsat Newsletter of December 1971 indicates disagreement even amongst experts on the definitions of "translators" and "repeaters" (not to mention "transponders"). "Transponder" he accepts as the most all-inclusive term, "repeater" means just that even if there is a frequency difference, and a "translator" changes the r.f. of the signal before re-transmission. After the Wodonga Agreement in 1968 "service" and "experimental" translators were adopted here, but nowadays nearly everybody uses "the repeater". However, as Bob says, a translator does not transcribe Japanese into English—for which you would still need an interpreter presumably.

STATISTICS

The P.M.G. lists at 30th September, 1971, reflect 6,447 licensed Amateur Stations in VK of which some 2,000 were A.O.L.C.P. This is an increase of about 1,700 in three years.

TECHNICAL ARTICLES

These are always welcome. Unfortunately, there have been long delays in getting them into print caused by draughting problems and hospitalisation. We have on hand a number of very good technical articles under process and planning for future "A.R's". These include articles by VKs 2ZTB, 5YS, 5ZIP, 3UG, 3BAF, 5BI, 2ON, 3ZKC, 4ZFD, 3QV, IPSD "TEP", 3AXU, 8KK, Clift and Tobin Rx Pt. 5, 5MF, 2ZQJ and 2BSG. Keep your fingers crossed for us that the ever increasing paper costs and printing charges can be overcome and, therefore, that these articles will appear in the journal as they should appear.

10 GHz.

A Conference organised by the I.E.E. in London for April 1973 will deal with propagation in the spectrum above 10 GHz. as there is such enormous congestion in the microwave band below 10 GHz. in the commercial segments. The Amateur bands at 10, 5.65, 3.3, 2.3 and 1.215 GHz., although shared, might appear somewhat unpopulated by comparison.

FEDERAL CONVENTION

The venue of the 1972 Convention at Easter (early this year) will be the Zebra Motel in Parkville, Melbourne. W.I.A. members are always welcome to come and listen to the proceedings. Assistance will also be needed in various fields such as recording, photography and general help.

A NEW POSTAGE STAMP

A new postage stamp is scheduled to be issued in Australia next year to commemorate the 50th Anniversary of the first regular radio broadcast in VK (W.A. Bulletin).

INCREASING LIFE OF TX VALVES

A brief article by VK3AXU on this interesting subject is contained in the November 1971 issue of "The Asian Broadcasting Union Technical Review". If interested, try an enquiry at your nearest b.c. or t.v. station, engineering branch.

SIZE OF "A.R."

The size of the journal has been under much discussion in addition to every other aspect. No change in the 11 x 8½ inch size was considered possible before next January.

SLOW-SCAN TELEVISION—THE AUSTRALIAN WAY

PART TWO

J. A. WILSON, VK3LM'T, and A. H. McKIBBIN,† VK3YEO*

Since our last article published in January 1972 "Amateur Radio", the authors have received a flood of mail and S.T.D. telephone calls from all over Australia and New Zealand requesting more information on S.S.T.V. in Australia. Are you still interested? Then read on.

AN S.S.T.V. MONITOR (SOLID STATE)

During the last month, a large number of requests have been received for an s.s.t.v. monitor, the demand for solid state or valve type being about equal.

Because our experimental units have not yet been fully evaluated, we propose to present the simple solid state monitor of Robert F. Ischannen, W9LVO, published in "QST" of March 1971—the valve boys will have to be patient for a little longer!

This monitor is simple and consists of several limiters, a discriminator, sync. and video detectors, video amplifiers and display c.r.t. (refer to the block diagram in Part 1, "Amateur Radio," January 1972). The sync. separator is followed by one-shot (monostable) multivibrator, discharge circuits and deflection circuits. A power supply supplies several different operating voltages and can use a high voltage generating system using circuits as used in t.v. receivers here in Australia, utilising standard t.v. components.

* 14 Merrilong Street, Ringwood East, Vic., 3135.
† 27 Beverley Street, East Doncaster, Vic., 3109.

CIRCUIT OPERATION

Transistors Q1 and Q2 (Fig. 1) provide limiting of any amplitude variations which may be present on the signal. The emitter follower Q3 drives a simple discriminator that consists of only a parallel-resonant circuit. An f.m. sub-carrier input to this circuit results in a sub-carrier output which is amplitude modulated. The signal splits at the output of the discriminator and is detected by two separate full-wave detector systems. (Note that full-wave detection doubles the sub-carrier frequency, permitting more effective filtering of the video and sync. signals from the sub-carrier.)

The video detector output passes through a low-pass filter and the video amplifier before reaching the c.r.t. (It should be noted that d.c. coupling is used from the video detector to the c.r.t. and also that direct coupling is used all the way from the limiter through the sync. amplifier and through all the deflection circuits.)

The sync. system is designed to provide good performance in the presence of noise and other undesired signals. The 1200 Hz. bursts which appear across the 1200 Hz. tuned circuit in the collector of Q6 drive the full-wave sync. detector and the sync. clipper. Only peaks of the detected signal forward bias Q8 so that sync. pulses and unfiltered sub-carrier appear at the collector of Q8.

Separate horizontal and vertical integrators provide clear sync. pulses to the two integrated circuit monostable multivibrators. These multivibrators provide the discharge pulses from which the saw-tooth sweeps are derived.

(Continued on Page 5)

DIVISIONAL DIRECTORY

NEW SOUTH WALES

Rooms: 14 Atchison St. Crow's Nest, N.S.W., 2065. Mon.-Fri. 10-12, 13-15 hrs. (15-21 hrs. on 4th Fri.). (Box 1734, G.P.O., Sydney, N.S.W., 2001.)
Admin. Sec.: Mrs. Judy Deans, ph. (02) 43-5795 (rooms).
Gen. Mtgs.: 4th Fri. (Dec.—3rd Fri.).
Council Mtgs.: Fri. before and Thurs. after Gen. Mtgs.
V.h.f. Grp.: 1st Fri. (Ch. VK2ZGW/T, Sec. VK2II).
Correspondence Courses: VK2IR.
Y.R.C.S. Supervisor: VK2BSJ.
W.I.C.E.N.: VK2GN.
Disposals: VK2ZIM.
QSL Bureau: Inwards—Hunter Branch, Box 134, Charlestown, N.S.W., 2290; Outwards—leave at rooms or to VK2ZTL (Box No.).
VK2AWI: Sun. 1100 hrs. 3595 kHz. a.m., 7146 s.s.b., 52.525 MHz. f.m., 53.866 MHz. a.m., 145.13 a.m., 145.9 f.m. (Ch. 4). Commun. Off. VK2AXJ, ph. (02) 793-9021. Hunter Branch, Mon. 1900 hrs. 80 mx.
Morse Code: VK2BWI nightly 1930 hrs. 3550 kHz.; Wollongong Tues. 53.982 MHz. a.m. For Morse Tapes contact VK2BMK.

VICTORIA

Rooms: 478 Victoria Pde., East Melbourne, Vic., 3002. Mon.-Fri. 10-15 hrs. (Box 36, East Melbourne, Vic., 3002).
Admin.: Federal Manager and Mrs. Enid Bellairs. Ph. (03) 41-3535.
Gen. Mtgs.: 1st Wed.
Council Mtgs.: 4th Mon.
V.h.f. Grp.: 3rd Wed. (Ch. VK3AUI, Sec. VK-3ZYK, Publicity VK3AOT/T).
S.w.l. Mtg.: Last Wed.
Theory Classes: Mon., Tues., Fri. (VK3ATP, VK3BCL, VK3ATT).
Corresp. Course: VK3ZZP and VK3AOH.
Y.R.C.S. Vic. Supervisor: VK3ZDK.
W.I.C.E.N.: VK3OR.
Components: VK3AS (Box 65, Mt. Waverley, Vic., 3149).
QSL Bureau: Inwards—to rooms, or Mr. E. Trebilcock, 340 Gillies St., Thornbury, Vic., 3071; Outwards—rooms or VK3XM.

Victoria (continued)

VK3WI: Sun. 1030 hrs. 1825 kHz. a.m., 3600 kHz. s.s.b., 7146 a.m., 53.032 MHz. a.m., 144.5 a.m., 146.0 (Ch. 1).
Morse Code: Lessons at rooms Thurs. by VK3JL.

QUEENSLAND

Address: G.P.O. Box 638, Brisbane, Qld., 4001. Mtgs. at Qld. Motor Sporting Car Club, 23 Boyd St., Bowen Hills.
Gen. Mtgs.: 2nd Thurs.
Council Mtg.: 1st Thurs.
V.h.f. Grp.: 3rd Fri. (VK4ZHA).
Y.R.C.S. Supervisor: VK4EV.
Classes: Wed. 1930 hrs.; Library VK4RL; Business Manager VK4OF.
QSL Bureau: Inwards VK4UA; Outwards VK-4RF (Stickers $0.65 per 100).
VK4WI: Sun. 0900 hrs. 3580 kHz. a.m., 7146 a.m., 14342 s.s.b., re-broadcast by VK4IE on 52.4 MHz. a.m. and 146.0 MHz. (Ch. 1) f.m., B/C off. VK4HB.
Morse Code: Tues.-Fri. 1930 hrs. 3580 kHz.

SOUTH AUSTRALIA

Address: G.P.O. Box 1234K, Adelaide, S.A., 5001. Mtgs. at Master Builders' Assn., 47 South Terrace.
Gen. Mtgs.: 4th Tues (exc. Dec.).
Council Mtg.: 3rd Fri.
V.h.f. Grp.: 1st Thurs., and Theory classes 3rd Thurs., at Goodwood Boys' Tech. High School (classroom on North side), Lily St., Goodwood.
Y.R.C.S. Supervisor: VK5FD.
QSL Bureau: VK5RX.
VK5WI: Sun. 0930 hrs. 1815 kHz. a.m., re-broadcast by VK5ZQ on 7125 kHz. a.m., by VK5KF on 14170 kHz. s.s.b., by VK5XV on 52.150 MHz. a.m., by VK5ZDX on 144.100 MHz. a.m., by VK5AWI and in Mt. Gambier 2 mx by VK5DK, in Darwin 2 mx by VK8CM. B/C Off. VK5XY.
Morse Code: VK5LG Mon. 1900 hrs. 3545 kHz.

WESTERN AUSTRALIA

Address: G.P.O. Box N1002, Perth, W.A., 6001. Mtgs. at Science House, 10 Hooper St., West Perth.

Western Australia (continued)

Gen. Mtgs.: 3rd Tues. (exc. Jan.).
Council Mtgs.: Last Fri.
V.h.f. Grp.: 4th Mon. in D.C.A. Workshops Canteen, 86 Guildford Rd., Maylands (Sec. VK6ZAF).
Y.R.C.S. Supervisor: VK6LO.
W.I.C.E.N. Off.: VK6DD.
QSL Bureau: VK6RU. Equipment Off. VK6DD. News ph. (092) 45-4793.
VK6WI: Sun. 0930 hrs. 3600 kHz. s.s.b., 7080 kHz. s.s.b., 52.656 MHz. f.m., also Sun. 1730 hrs. 14100 kHz. s.s.b. B/C Off. VK6HP.

TASMANIA

Address: G.P.O. Box 851J, Hobart, Tas., 7001. Mtgs. at the Club rooms, Room 6, 147 Liverpool St., Hobart.
Gen. Mtgs.: 1st Wed. (exc. Dec.).
Council Mtgs.: 2nd Mon.
V.h.f. Grp.: 3rd Wed.
Y.R.C.S. Supervisor: VK7KK/T.
Equipment Off. VK7ZMK.
QSL Cards: G.P.O. Box 371B, Hobart, Tas., 7001.
VK7WI: Sun. 0930 hrs., 3672 kHz. s.s.b., 7130 a.m., 53.032 MHz. a.m., 144.10 a.m.

OTHER AREAS

QSL Bureau: See 1971 Australian Call Book, page 55.

FEDERAL DIRECTORY

Rooms: 478 Victoria Pde., East Melbourne, Vic., 3002. (Mon.-Fri. 10-17 hrs.). Ph. (03) 41-3535. P.O. Box 67, East Melbourne, Vic., 3002.
Manager and Sec.: Peter B. Dodd, VK3CIF.

NOTES

Times given are local. Mtgs. begin 2000 hrs. unless otherwise stated. It is hoped to publish this Directory each half year and updating information is requested. Part 2 will appear later after Annual General Meetings have appointed office-bearers—for 1971-72 details, please see Sept. "A.R." p. 15. W.I.A. Clubs/Zones are requested to advise similar reference details for inclusion in a future issue.

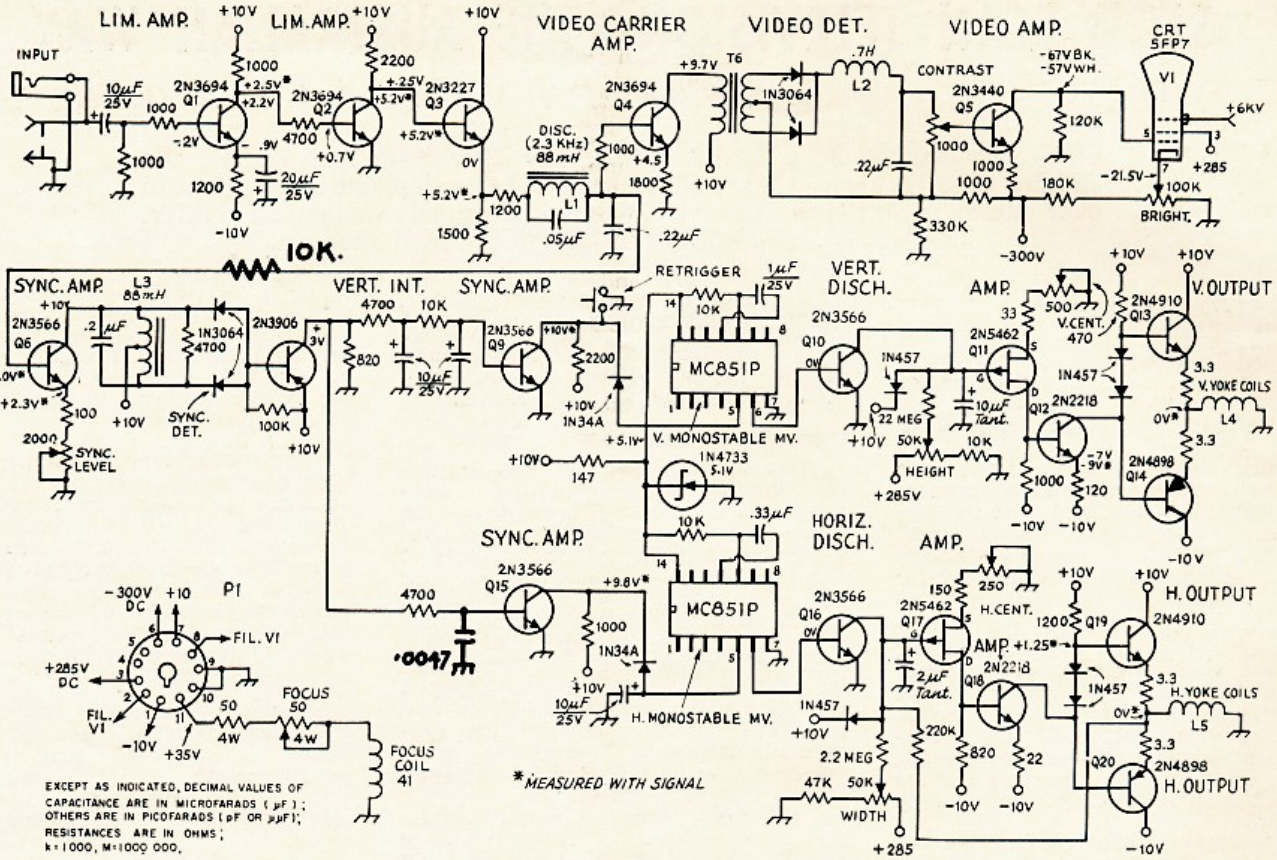
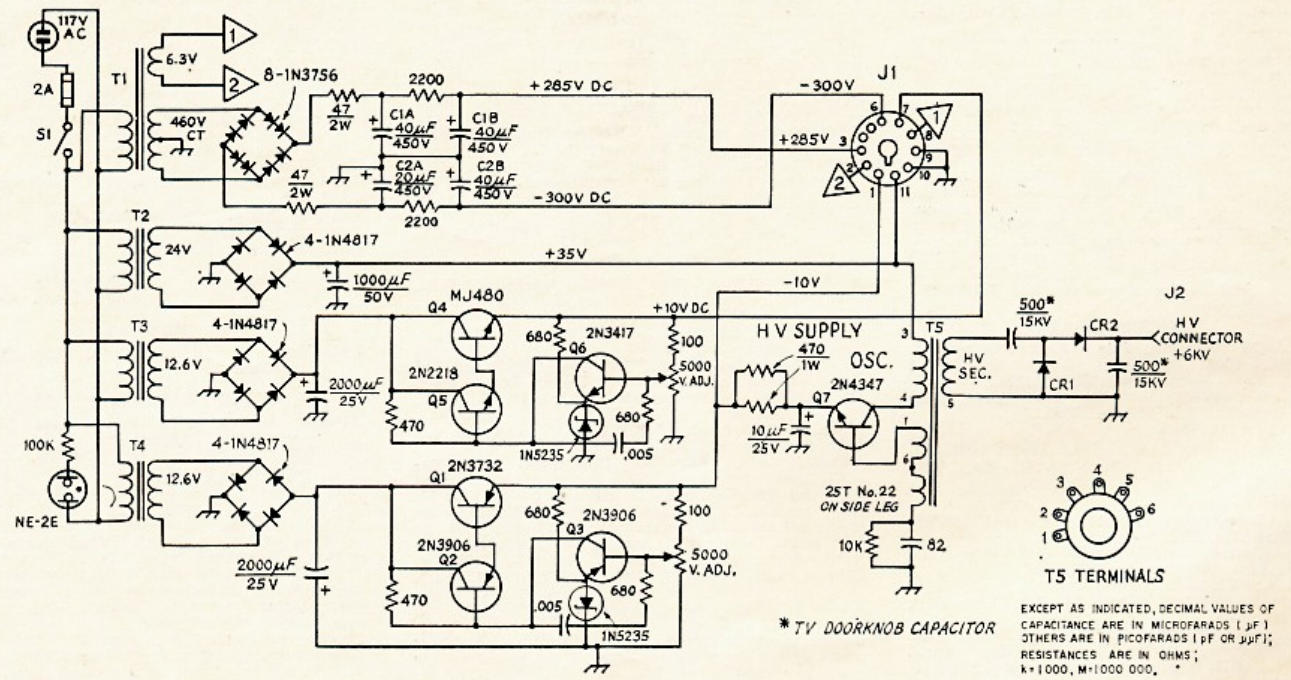


Fig. 1 — Circuit Diagram for the slow-scan monitor. Fixed-value resistors are composition. Fixed-value capacitors are disk ceramic, 600 volts, unless otherwise indicated. Polarized capacitors are electrolytic.

Fig. 1B — Circuit diagram of the power supply.

CR1, CR2 — 6-kV PRV rectifiers (Varo VB-60).
L1, L3 — 88-mH toroid.
L2 — .7H filter (Stancor A-3876, primary).
L4, L5 — Deflection yoke for 50-degree CRT. Typical values are: Vertical coils, 30-65 mH, 30-60 ohms dc resistance. Horizontal coils, 8-30 mH, 12-45 ohms dc resistance.

T1 — Power transformer (PC 8418 Stancor).
T2 — 25.2 V, 1 A (Knight 54D1421).
T3, T4 — 12.6 V, 1.5 A (Knight 54D1420 or Triad F25X).
T5 — Flyback transformer (RCA 116122).
T6 — Interstage, 500 ohms (Knight 54D4174).



The sync. level control in the emitter of Q6 permits the operator to adjust the clipping level to enable him to cope with some types of unusual interference. In general the control can be left set or may be altered to receive and lock pictures being received from either 50-Hz. or 60-Hz. systems.

Early in the study of on-the-air performance of the monitor, it was found that good noise immunity could be obtained only if direct coupling was retained throughout the sync. and deflection systems. For example, if different charging paths are present in the sweep generation system, there will be a tendency for the trace to take several sweeps to stabilise after a burst of noise or interference. This condition is intolerable, particularly in the vertical deflection circuits where several sweeps would require a total time of 16 or more seconds.

The principles of operation of the vertical and horizontal sweeps are the same. The output of the monostable multivibrator provides a positive pulse. The tantalum timing capacitors charge until a positive pulse drives the discharge transistors Q10 and Q16 into high conduction. This immediately discharges the capacitor and the process begins again. A saw-tooth wave is of course the result.

The "N" channel junction FET transistors Q11 and Q17 present high impedances at their inputs and do not discharge the saw-tooth forming capacitors via their input circuits. By setting the operating point of the FET, centering of the trace is achieved. This system is simple and does not degrade the sweep linearity when used within the normal range of centering.

Complementary symmetry transistors in the output system provide a convenient means of maintaining d.c. balance through the deflection coils. The two diodes permit both output stages to remain in conduction during the "**overlap**" region near the centre of the sweep. In other words, an offset bias between the two transistors is provided so that neither of the two transistors will cease conduction before the other takes over.

DEFLECTION YOKES AND FOCUS

5FP7 and similar type tubes have a magnetic deflection angle of 50°, therefore we can use a 70° yoke obtained from early model t.v. receivers. The types found most suitable were located on early model Classic and Bush Simpson t.v's. These units have an **iron** core and **require small amounts** of current to deflect the trace to enable correct picture scanning. Other type yokes that have ceramic cores are only suitable in solid state circuits when high current output transistors are used.

Suitable yokes and magnetic focus magnets can be found in early type t.v's fitted around the following picture tubes:—

Tube Type	Deflection	Focus
14BAP4	Mag.	E/S.
14CP4	"	Mag.
17BP4B	"	"
17BP4D	"	E/S.
17DWP4	"	"
172K	"	Mag.
173K	"	"
CRM171A	"	"
CRM172A	"	"
MW43-64	"	"
MW4-369	"	"
21BCP4	"	E/S.
21YP4	"	"
21ZP4	"	Mag.
21ZP4B	"	"
21ZP4C	"	"
CRM211	"	"
CRM211A	"	"

C.R.T. TUBES

Since the publication of Part One of this article, 3FP7 tubes previously available in Melbourne have been purchased by prospective s.s.t.v. constructors. However, it is understood that 5FP7 tubes are still available in Sydney, **but** beware of the high prices that are being asked for them in some areas.

RE-GUNNING OF OLD GLASSWARE

As mentioned earlier, negotiations with a picture tube re-gunning company to produce tubes suitable for s.s.t.v. are continuing. At present they are setting up a line to re-phosphor and re-gun any type glassware, whether c.r.o. type tubes or picture tubes. You provide the glass and the tube will be re-built using a standard t.v. gun assembly, and re-phosphored.

A sample tube from this company has been received and is at present being evaluated. The major advantage is that the phosphor is not sensitive to external light being placed on the surface of the tube, therefore the pictures can be displayed under normal room lighting conditions. As it may be realised, the disposal type tube has a P7 phosphor that can be activated by room light as well as by the electron beam, therefore pictures have to be viewed under low-level room lighting conditions. With this new type of phosphor assembly, we may have a **first** as far as s.s.t.v. is concerned—i.e. **s.s.t.v. viewed in a fully lighted room.**

Using a normal t.v. gun assembly means that boost voltage will have to be supplied for the electrostatic focus. Normal 6.3 volt heaters are used and even though the e.h.t. voltage will be high (10-13 kv.) it allows the tube to give excellent brightness characteristics. Further information and a report on the above type tubes will be given on request.

POWER SUPPLIES

Low Tension Supply

The general power supply (see Figs. 4 and 5) may take any form to suit the individual and also the components on hand.

The first requirement is a +10, —10 volt supply, regulated to handle a maximum of 1.5 to 2 amps. As an alternative to the original, there is a practical circuit using fewer components than the original article suggested. This circuit is a reprint from "Radio Communications", Feb. 1971. Some monitors require +10 volts only—a saving in power supply requirements.

High Tension Supply

The required plus and minus 300 volts (Fig. 6) can be obtained using a t.v. power transformer with a bridge rectifier and pi-type filters. The value of "R" and "R" bleed can be installed to suit the type of transformer selected.

E.H.T. Supply

Probably the easiest way to generate e.h.t. (Fig. 7) is to use an old t.v. line output transformer with a 15 kHz. multivibrator oscillator as the generator. The e.h.t. requirement will be governed by the type of c.r.o. tube used for the display. The multivibrator speed of the oscillator is not critical and therefore does not have to be

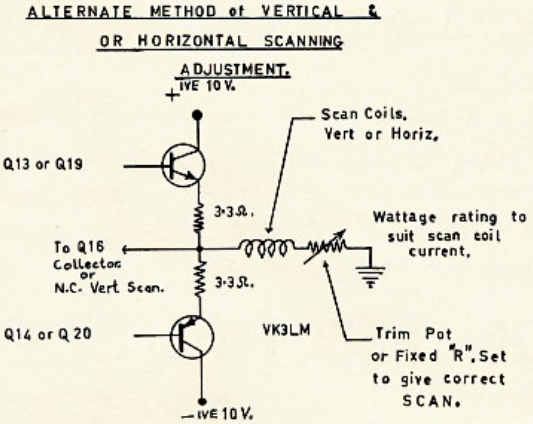


FIG - 1a.

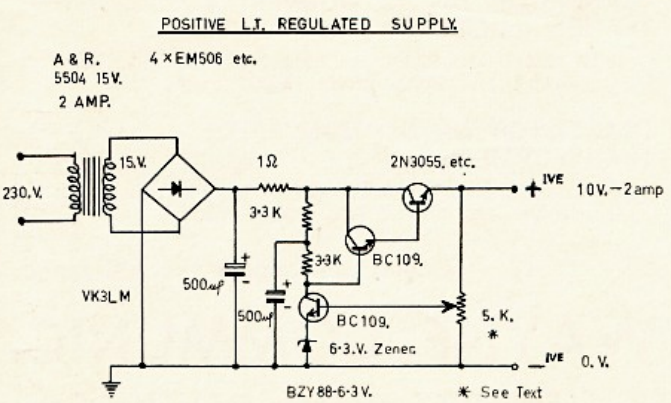


FIG - 4.

exactly 15.625 kHz. as in television where line sync. is required.

Any speed plus or minus a few kilohertz will generate sufficient drive to excite the driver tube. The oscillator coil used was an old Astor type, but any television type will suffice. A little load may have to be applied to the line output transformer and this has been achieved by using a width coil across that part of the l.o.t. winding normally used for yoke connections.

Final filtering of the e.h.t. supply is achieved by using a 1000 pF. 25 kv. door knob capacitor. Any ripple in the supply will be evident on the raster and is intolerable with this small size picture. **Door knob** capacitors are available from Radio Parts, Spencer Street, Melbourne. The output voltage (final e.h.t.) may be increased or decreased by varying the conduction rate of the driver tube. This is achieved by varying the size of the screen resistor to the 6CM5.

The drive from the multivibrator oscillator to the grid of the 6CM5 should be about 40 to 45 volts negative. The actual e.h.t. required will depend on the type of picture tube or c.r.o. tube used.

Although a valve type e.h.t. supply is shown, a solid state type can be developed along similar lines. Ideas can be obtained by using parts of the line output stage circuitry of any **solid state** type t.v. using the values given in the diagram of the receiver circuit selected.

The only reason a solid state unit (e.h.t. power supply) was not published was because insufficient time was available prior to publication of this article to build and evaluate same.

SPECIAL COMPONENTS

L1 and L3 are shown as 88 mH. toroids as these are plentiful in the States. A.W.A. width coils type 40047 were successfully used, each one tuned with a fixed value C. For the 2.3 kHz. trap C was 0.1 μF. and for the sync. detector trap C was 0.2 μF. Merely feed an audio oscillator into these traps at the required frequency and tune the coils to give maximum output as viewed on an oscilloscope at either (a) 2.3 kHz., or (b) for the sync. trap at 1200 Hz. Note that any similar coil and C suitably adjusted as above will do the job.

L2 is suggested as a 0.7 henry choke. The secondary (15-ohm winding) of a small speaker transformer was used and this gave excellent filtering.

T6—here a transformer originally used as a driver for push-pull audio stages in cheap transistor portables was used.

As stated earlier, component values are not critical, hence the wide latitude with some components.

All the transistors and ICs stated on the circuit diagrams are available from supply houses in Australia, with the exception of the "N" channel FET type 2N5462. A Fairchild type 2N3460 was used, but almost any "N" type should suffice.

An alternate monostable multivibrator to the Motorola MC851P is Texas Instrument type SN15851N.

FINAL ADJUSTMENTS

The design is such that if the components for the tuned circuits are selected with reasonably close tolerances and tuned up as stated earlier, very few adjustments should be required.

Note.—This type of monitor requires an s.s.t.v. signal to be fed into the input circuit before the scanning raster will be seen on the screen, then a tape of a good picture with correct sync. level signals present should be fed into the monitor.

The vertical and horizontal centering controls, together with the height and width controls, are adjusted for an aspect ratio of 1:1. If over-scanning results, potentiometers or resistors are added in series with the deflection yoke vertical and horizontal scan coils. These will trim the picture to give full use of the c.r. tube's surface area.

While the signal is being fed into the monitor, the sync. level control is adjusted so that the horizontal scan develops and also that clear horizontal and vertical sync. pulses are obtained at the outputs of Q9 and Q15. These pulses should be free of sub-carrier.

The pulse at Q9 will of course appear only every eight seconds. Clean positive-going pulses should also appear at terminal 6 of each of the integrated circuits.

This slow-scan monitor should provide a stable and cool-operating, reliable monitor. Any Amateur requiring further information related to this monitor can contact VK3LM at the address given.

LIST OF ALTERNATE COMPONENTS

Coils

1. L1, L3, A—Any t.v. line oscillator coil, e.g. A.W.A. 40047, etc.
2. L2—Any winding, speaker transformer secondaries, etc.
3. "B"—Parasitic chokes, t.v. types.

Transformers

1. T6—A & R TD3 driver transformer or any driver transformer of approximate ratio.
2. T1—T.v. line output transformer, any type, any deflection, e.g. Astor, Philips, A.W.A., either 70, 90 or 110° deflection. Type used, Telecomponents TV4722 as this was the one on hand.

Semiconductors

1. Q11, Q17.—Fairchild 2N3460 or any "N" type FET. **Note.—Do not** fall for the trap and use "P" types that may be on hand.
2. ICs—Texas Instrument's single shot monostable vibrator type SN15851N or similar.

   All other types are available in Australia or cheaper alternate types may be used.

Deflection Yokes

Any 70° or 90° **iron** core type for 5FP7, 3BP7 or 7BP7 or similar tubes. These can be easily deflected with low drive currents. Obtained from Bush Simpson or Classic Televisions. Other types will require high currents to drive them.

Note.—Electrostatic type tubes require no deflection units.

Video-Amp. Transistor

1. Any 300 volt type, e.g. MJE340.
2. All resistors are $\frac{1}{4}$ or $\frac{1}{2}$ watt types.
3. Potentiometers are $\frac{1}{2}$ watt shaft or pre-set whichever you prefer.
4. Allow for three input jacks to be mounted on the monitor panel. These will be used for:—
   (a) **Scanner in** (monitor your own pictures).

(continued next page)

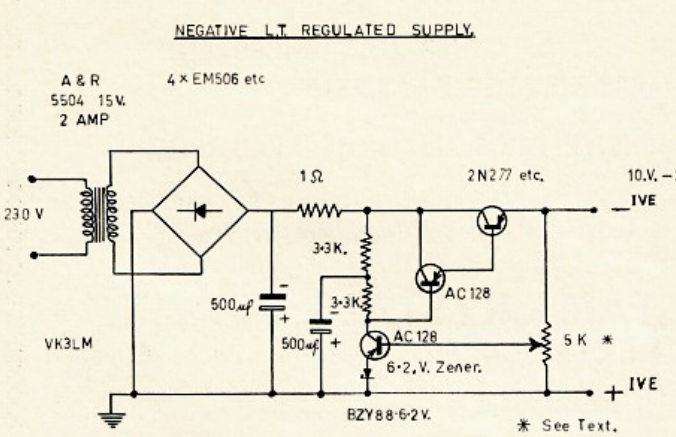


FIG - 5.

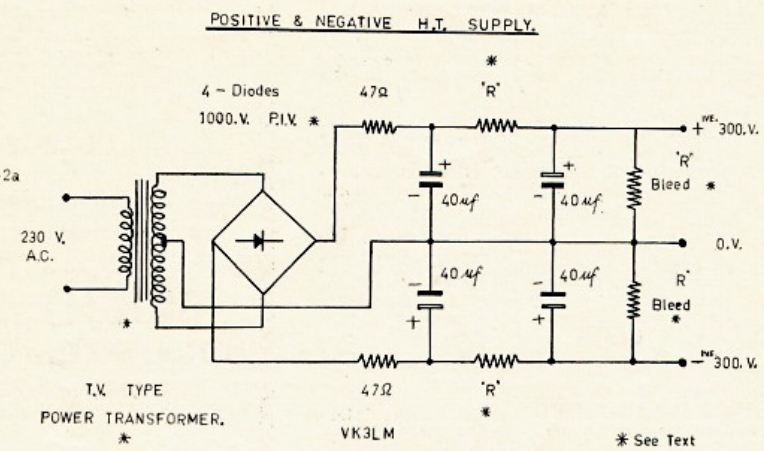


FIG - 6.

(b) **Receiver** (picture being received over the air).

(c) **Tape Recorder** (for recording pictures being sent in or out).

Note.—The limiter stages of this monitor will handle all signals from 0.2 mV. to 10 volts.

So until Part Three on S.S.T.V. Scanners, happy s.s.t.v.-ing to all.

"Wally" VK3ABM at the controls of his s.s.t.v. station. Seen are (1) left, the W6 Esky Monitor, as built to MacDonald circuit March '64 "QST"; (2) extreme right, "Videocon" type camera (valve unit); (3) centre, title display of Wally's own call and response to Ian ZL1AOY on 14230 MHz. during a recent s.s.t.v. contact.

PERSONALITIES AND S.S.T.V.

This month we would like to introduce to you Waldo Porter, VK3ABM. Known to his friends in Amateur Radio as Wally, he can be heard operating s.s.t.v. on 14.230 MHz. late at night once or twice a week.

Coming originally from North Carolina, U.S.A., Wally first obtained his licence under the call W4LD and in 1940 took up his occupation with a large aluminium company. Today he is managing director of that company in Melbourne. After the war, he obtained the call W7LK, then was later transferred to Pittsburgh where he operated under the call W3LK.

In South America during the last four years, Wally operated as PZ1DA and became interested in slow-scan t.v. He obtained an Esky monitor which is built to the McDonald circuit of "QST," March 1964. Later Wally built the slow-scan vidicon camera by McDonald, published in "QST," June, July and August 1965, followed by a control system which was published in an article in "73" as "An S.S.T.V. Patch Box" (Feb. 1971).

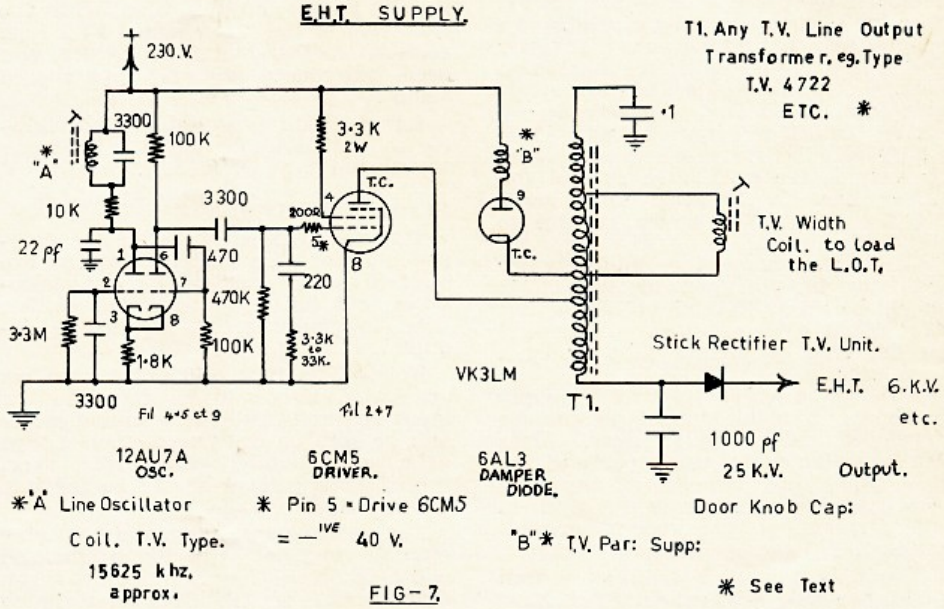
Using this system, Wally has a very nice set-up where titles can be displayed using magnetic movie title letters in white on a black background. Shown on the front cover is a photograph of one of Wally's call frames. Note the kangaroo featured in the centre of the frame.

Arriving in Australia just before Christmas, Wally obtained the call sign VK3ABM and has made his presence felt among the Amateur fraternity here in Australia. Whilst in South America, one of Wally's biggest thrills in s.s.t.v. was to receive a photograph of his daughter Sydney, who is licensed under the call sign W4PUB, via the slow-scan screen. In Wally's opinion, along the equator is the best location in the world for receiving the finest signals via slow-scan. "They come in from everywhere," was his comment. The worst operating area to his knowledge was Pittsburgh where signals were almost non-existent.

Today, Wally's station consists of a Collins receiver 75S-3B, transmitter Drake TX4, and a dipole on 20 metres pro tem. In Fig. 2 Wally can be seen operating in front of his very impressive station. If you would like to meet Wally, come up around 14.230 MHz. and say hello.

ACKNOWLEDGMENTS

Wally Porter, VK3ABM.
Jack Smith, of Ringwood—photography.
Articles from "QST," March 1971.
Joan, VK3LM's wife, for typing the articles.
Ian Young, ZL1AOY, for transmission of s.s.t.v. pictures.



FIG—7.

BAND PLANNING

Mr. S. Voron, VK2BVS, in a letter too long to publish in full, advocates band-planning in VK-ZL be co-ordinated for v.h.f. and h.f. to stimulate usage of frequencies and to consider and formulate new ideas of benefit to the Amateur Service.

His suggestions covered—

(a) A calling frequency in the 10 mx band at, say, 28.5 MHz. (15 mx and 20 mx are our main DX bands, the latter has to cope also with local working—the other bands possess high static levels or high powered intruders); 10 mx band is wide, suitable for ground-wave working, very good for hand-held transceivers — even converted from 27 MHz. rigs quite simply—many stations already operate on 10 mx—QRM on 10 mx is less—very handy too for portable and mobile stations.

(b) When contact is made on the calling frequency QSY to any one of pre-selected xtal locked frequencies from say 28.3 to 28.5 MHz.

He invites ideas and suggestions from interested readers, particularly in the more heavily populated centres, to 60B Dutric St., Randwick, N.S.W., 2031.

The Practical Design of Mobile Aerials*

E. L. GARDINER,* B.Sc., G6GR

A great deal of scattered information has appeared from time to time both in England and in America in relation to the practical effectiveness of numerous types of aerial system when used on moving vehicles.

It is hoped that this survey will help newcomers to the mobile field to avoid some of the common pitfalls, and that others having wider experience may find at least a few pointers which will assist them in improving performance. At the same time a review of the systems in general use may suggest a few new lines for experiment which can be expected to yield worthwhile results.

MOBILE OPERATION

Consideration of true mobile operation from vehicles in motion as opposed to the related fields of portable, "static-mobile," and /A operating, suggests the following fundamental requirements which must be met:

(a) Since the vehicle is continually changing its position in relation to other stations, the aerial system should be essentially non-directional. Any directional characteristics, however slight, may be expected to increase fading and variations in received signal strength.

(b) Much mobile communication is by ground-wave at comparatively short ranges, and in this sphere as well as that of ionospheric reflection, low-angle radiation is perhaps as important as at the home station.

(c) Since the power of mobile installations is necessarily limited by considerations of power supply and battery capacity, efficiency in the aerial system and in the transfer of energy to it is of prime importance.

(d) The aerial should be so positioned on the vehicle as to pick up the minimum of electrical interference, both from the car itself and from any passing traffic. It should be clear of avoidable screening, and as remote as possible from surrounding objects which can detune the aerial and absorb valuable power.

(e) In addition to the above requirements, the mobile aerial must be mechanically safe and sound in design. It must be strong enough to withstand high cruising speeds, have low wind resistance, and either be **resilient** in itself or **resiliently** mounted to withstand accidental impacts. Preferably, it should be neat in appearance and easily removable for parking and garaging. If in addition to these factors is added the facility for remote tuning, and perhaps frequency change, from the driver's seat, it will be clear that any successful design is certain to include a strong element of compromise, and is in fact a major exercise in engineering skill.

Further consideration of the Amateur wavebands available for mobile use suggests that there is a natural line of demarcation which occurs at the frequency where a half-wave dipole becomes comparable to the length of the vehicle, namely in the region where h.f. merges into v.h.f., particularly the 10 metre band. From the earliest days of mobile working there has been a widespread, although not inevitable, choice of the vertical radiator, as this fits naturally into most of the requirements listed.

At 30 MHz. a quarter-wave whip aerial is approximately 8 ft. in length, and approaches the maximum which can be carried safely. At all higher frequencies a resonant aerial becomes small in relation to the vehicle, so that there is a wide choice from among many of the established v.h.f. designs, many of which can be carried on a car if they are thought suitable. A simple quarter-wave vertical is not out of the question for the 21 MHz. band, but from this frequency downwards it becomes characteristically necessary to load the aerial electrically in order to achieve resonance in a structure small enough to be carried safely. Thus, in mobile operation the Amateur bands fall into two classes, namely the h.f. bands upon which DX working is to be expected, and characterised by the necessity for loaded aerials; and the v.h.f. bands upon which true DX is the exception, and characterised by the use of unloaded and possibly more complex aerial systems.

The first section of this review will discuss v.h.f. mobile aerials, perhaps the simpler of the two classes, if the broader in scope. Commercial users of v.h.f. radio appear to have little doubt that the system best suited to their needs is the quarter-wave vertical rod, mounted at or near to the centre of the metal roof of the vehicle, and the author cannot recall having ever seen any important departure from this practice.

However, the commercial user has the advantage of wishing to communicate, in the vast majority of instances, with only one, or at most, a few fixed stations. These invariably employ stacked vertical systems erected at great heights in carefully chosen locations. The mobile Amateur, on the other hand, may wish to communicate with all and sundry other Amateur stations, most of whom use horizontal polarisation, in addition to other mobiles in his area; and this complication gives rise to a great deal of hard thought and discussion.

V.H.F. AERIALS

At frequencies above 70 MHz. the roof-mounted vertical can be truthfully thought of as a ground-plane, since the metal area over which it is mounted will not be smaller than a quarter-wavelength in radius, and thus simulates a radial system, or perfect ground. There can in fact be little doubt that at any frequency a central roof position is probably the best obtainable since it has maximum height above ground combined with minimum screening by the vehicle itself. It is also as remote as possible from all sources of electrical interference both internal or external, and should be as nearly omnidirectional as can be achieved.

However, the use of roof-racks, or of a "soft-top," may not always permit this ideal arrangement, but experience has shown that the aerial can be offset without serious loss of efficiency; probably the best position being towards the front of the car roof, immediately above the windscreen. This position has the advantage of remaining broadly central above the metal mass of the car as a whole, and yet it permits a short run of feeder to the most usual position of the equipment near to the dashboard.

While it is not uncommon to drill the roof of a commercial vehicle to support a whip, this procedure is unlikely to appeal to the Amateur who owns his own car! Among those who have effectively solved this problem may be mentioned G8CK/M, who makes use of one-half of the well known "ski-rack" which consists of a single bar fitted with the usual clamps to secure it across the car roof in any position. This can be fitted well forward of any obstructions, and the aerial mounting clamped to it; the method being suitable for any frequency and in no way confined to v.h.f. In practice it is not always preferable to earth the outer braid of the aerial feeder to this rack, and improved results have been noted in certain installations when the braid is left floating and earthed only at the equipment end.

It is strongly recommended that both forms of connection be tried, without regard to the type of aerial or frequency-band in use, since there have been instances where a signal increase of up to 12 dB. has been reported by distant stations when the remote end of the feeder is lifted from the car body. This effect is not universal, however, since the car body is a very individual structure, and in many instances earthing in the more usual manner is essential.

A second approach to the mounting problem places the aerial upon a small matching unit or terminating box, which in turn is secured to a square of material such as copper sheet or plywood. The latter is then attached to the car

* Reprinted from "Radio Comm.," July 1971.

roof by a suitable harness similar to that used for roof-racks, or even by a strong adhesive tape. The feeder is not taken through the roof in what may be regarded as the ideal manner, but at right angles from the aerial mounting and over the roof to enter by a convenient side window. It should, of course, be an insulated cable throughout, and the off-set or forward roof position may be preferable at lower frequencies if it makes possible a shorter feeder.

OPTIMISING THE FEED ARRANGEMENTS FOR WHIPS

It can be stressed at this point that it is a widely held view that a short and direct feeder run to the mobile aerial is of very real assistance, as it is rarely possible to arrive at and to maintain perfect impedance matching under mobile conditions and in consequence feeder losses cannot be neglected. Moreover, it is very advisable to keep the feeder as remote as possible from the electrical wiring and equipment of the car, and the effective bandwidth over which the aerial can be used without alteration tends to be wider if the feeder is short.

The author has ventured to express the opinion that in practice it is more beneficial to select a feeder cable of low loss construction and having the lowest self-capacitance per foot, and to keep this to the absolute minimum length, than to select a cable which is a correct nominal impedance match to the aerial system. In the extreme case of a low frequency transmitter which can be coupled to the aerial by a feeder of virtually zero length and capacitance, it is possible by means of a conventional pi-network to feed at useful efficiency over a considerable bandwidth; whereas in the case of the conventional mobile installation employing a relatively long feeder-run this width is very restricted, seldom exceeding 25 KHz. on top band.

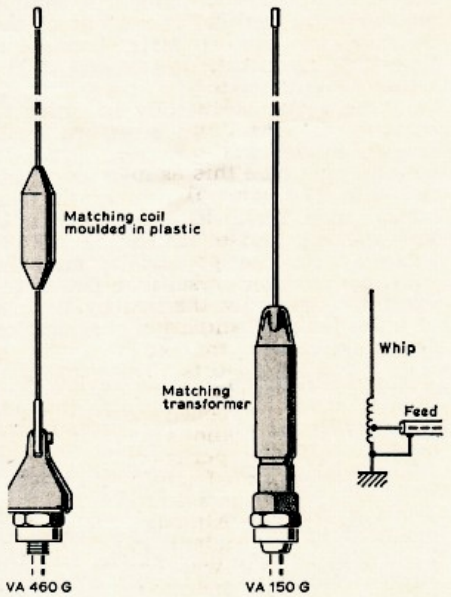
It is usual to feed the quarter-wave ground plane directly by a short 50 ohm feeder, which will not be a very good match into the estimated aerial impedance in the region of 20 ohms. Two feeders in parallel have been used, but there seems no evidence that any worthwhile improvement in matching can be claimed. However, it has been pointed out in an admirable article by G4LU and G3BA that improved matching can be obtained if the aerial is lengthened to about one-third of a wavelength, which can exhibit a resistive component of 75 ohms, while the added inductive reactance introduced by the increased length is tuned out by a series capacitor incorporated in a matching unit at the base of the lengthened whip.

These Amateurs have used an offset mounting at the side of the car roof with success, and it is a further advantage of the lengthened radiator that its impedance is less dependent upon strictly ground plane conditions, and that the use of a suitable matching unit at the base enables the effects of differing aerial position to be compensated. They have further expressed the view that a correctly matched vertical system is not materially inferior to others when working home stations using horizontal polarisation, while being better for communication from car to car.

STACKED AERIALS

At the higher v.h.f. bands it becomes practicable to stack vertical radiators, and this construction will prove very helpful at 432 MHz. W2ALR has described an aerial where the usual quarter-wave vertical rod is continued into a "quarter-wave stub", which on 144 MHz. can take the form of a half-wave section bent into circular form, and above this the whip continues vertically for a further half-wavelength section. Such a colinear stack would be some 10 feet in overall height for the 2 metre band, and although this might be regarded as excessive for safety when roof mounted, it would be quite suitable for a rear bumper position, when the upper half-wave would be in the clear.

On 432 MHz. the structure would be more nearly 40 inches in length, and thus safe at roof level, while an additional half-wave stacked element could be added without exceeding a reasonable height. These possibilities make the band potentially attractive for mobile experiment. A construction which appeals to the author for open-car use is based upon the rear bumper mounting of a short insulating section of wood or bakelite tubing, perhaps 4 ft. in length, above which can be carried a centre-fed vertical dipole for 2 metres, or a stacked array for higher frequencies. The "J" match construction described in most Handbooks also lends itself well to mobile mounting, being fed from the bottom at low impedance. A rear-mounted aerial of this form would be 10 ft. in overall height for the 4 mx band, and therefore has much to recommend it as a departure from the simpler varieties.



Two Pye aerials in which attention has been paid to ease of fitting to any vehicle. The mountings supplied are weather-proof and maintain a low resistance bond to the vehicle metalwork.

The type VA 460G u.h.f. three-quarter-wave aerial is intended for operation in the band 450-470 MHz. Inherent gain combines with height to give a high performance aerial. The radiating element consists of stainless steel rod with a sealed phasing coil placed in it quarter-wave from the base. The complete assembly is carried by a hinged clamp on an insulated base.

The type VA 150G v.h.f. half-wave aerial is for operation in the band 146-175 MHz. The greater height of this aerial is an advantage where a partially-screened mounting point must be used. The aerial consists of a tapered stainless steel rod mounted on a sealed matching transformer. A 12 ft. length of co-axial cable is provided with the aerial and this can be supplied full length or cut for a specified frequency; a cutting chart is also supplied.

HORIZONTAL POLARISATION ON V.H.F.

For the Amateur who feels that horizontal polarisation at v.h.f. must be retained, there are several well known designs which aim to overcome the too-directional pattern of the horizontal dipole. Of these the halo aerial, which consists essentially of a dipole centre-fed with the aid of a gamma matching section to overcome the altered impedance, and having the two ends bent round, without contact, into a circular form, is very well established.

The construction is not entirely effective in overcoming directional pattern, and has maximum radiation in the direction of the feed point; there is some doubt if it is as effective in this respect as the vertical whip.

The halo is mounted above the car, preferably not less than a half-wavelength above roof level, as at lower heights there will be a tendency for the roof or body of the car to reflect radiation upwards. It has the advantage of small size and weight.

The "minihalo" has recently appeared in which the diameter can be halved by joining a capacitive sleeve between the two previously open ends, resulting in a still greater reduction in these factors. It is, however, axiomatic that the field radiated by an aerial is a function of size, and any reduction will normally have some detrimental effect upon efficiency.

An interesting possibility becomes evident at this stage. Although the author has not yet seen this development in use, it should clearly be possible to so dimension the minihalo that with the capacity-sleeve in place it resonates in the 70 MHz. band, while with this removed or replaced by an insulator it will resonate in the 144 MHz. band, thus providing a useful two-band assembly.

The search for still higher effectiveness from horizontal polarisation has led to the development of the cloverleaf aerial, described in current Handbooks, which is equivalent to three half-wave halos fed in phase. The aerial has more uniform directional characteristics, and an appreciable power gain over a dipole or halo, but at the expense of a rather conspicuous appearance and relatively high wind resistance. While of undoubted excellence, it may be regarded by many Amateurs as better suited to portable or "static-mobile" working.

Aerials of this nature are unlikely to be chosen for frequencies lower than 144 MHz. owing to their size and weight, and for the under-used 70 MHz. band, vertical structures, or the halo, would appear to be a wiser choice. The 10 metre band has the distinction that a full-sized quarter-wave vertical aerial approximately 8 ft. in length without inductive loading can be carried on the average car. It is possible to roof-mount such an aerial in the "ground-

plane" position, giving perhaps the highest radiating efficiency obtainable on any of the Amateur bands, but more often considerations of overall height and of accessibility for band changing lead to the choice of a lower mounting position. At this frequency, where the car body approximates in dimensions the "other half" of a dipole, it is easy to see that much of it may be expected to be "hot" at r.f., and it is not always fully appreciated that this is the normal state of affairs on all bands with the possible exception of the higher v.h.f. bands, as at lower frequencies the vehicle body is far too small to represent an earthed mass, or to simulate a true ground plane.

H.F. AERIALS

POSITIONING THE LOADING COIL

On bands lower in frequency than 28 MHz., a vertical aerial structure is the only type widely used, as it conforms relatively well to the requirements listed in our opening paragraphs. As loading is introduced, however, technique divides into two well defined streams, namely "base-loading" in which the necessary added inductance to provide resonance is added at the base of the vertical whip where it enters the vehicle, and "centre-loading" in which the loading coil appears at some point higher up the radiator, generally at from 4 to 5 ft. below the highest point. These two streams can be further sub-divided according to whether the loading coil is interchanged for each band used, or whether some form of continuously variable tuning is incorporated into the design.

Structurally these two systems differ considerably, in that base-loading places the coil conveniently for access, reduces the weight and wind resistance of the whip, and tends towards neatness and mechanical strength; whereas a higher position for the coil adds to these problems. It can be shown, however, that in the case of large aerial structures in which base, centre or even top loading really have significance, there is a marked increase in efficiency from placing the loading coil at the maximum height above ground. This provides a long section of aerial below the coil in which r.f. current is a maximum, and which contributes greatly to the radiated field.

The mobile aerial, however, becomes very small in terms of wavelength at the lower Amateur frequencies and is more heavily loaded with inductance than are most home-station verticals. The distance between the coil and car body is seldom more than two or three feet, so that the change in current distribution as between the two systems cannot be very profound. It is pointed out by advocates of base loading that as a result of the greater top-capacitance of the longer whip, the coil inductance can be materially lower than is necessary for centre loading, thereby reducing r.f. resistance. But this factor will, in addition, tend to reduce the r.f. potential across the coil, and it is suggested later that it can be of much greater importance to maintain a large potential.

The argument is strongest on top band, where the mobile aerial system is perhaps less than two per cent. of a wavelength overall, and experiences on this widely used band may be expected to apply in a decreasing degree to the DX bands as frequency is increased. The author once carried out a series of tests on top band in conjunction with a remote field strength meter, in which the coil position was progressively moved up a mobile aerial while keeping the feed current and all other factors as constant as could be devised. These tests showed quite conclusively that the radiated field at some 40 yards from the car was most nearly proportional to the height of the midpoint of the loading coil above ground, and **not** to that above either the feed point, or the point of attachment to the car body. In these tests, of course, the ground level means nothing electrically, as the true "ground" may be some distance below the surface of a dry road. It must be taken as equivalent to the lowest point of the car body, namely that where the wheels meet the road.

From tests such as these, even if the agreement is only approximate, it becomes clear that the whole vehicle is effectively part of the aerial system, and that there is no fundamental distinction between base and centre loading, for the one merges continuously into the other from a performance point of view. If this were not so, and the car body played no part in radiation, it would be hard to understand the effectiveness of such popular mobile aerials as the G3FIF, which is normally used with the coil immediately above the mounting point, and thus has no bottom section at all to carry maximum r.f. current. It is clear that the important factor is loading-coil height, and the mobile installation should be designed to improve this as much as practical considerations allow.

It is interesting to note that some users, for example G3KNB/M, have, after installing the popular aerial mentioned with good results, raised it a few feet further by the introduction of a bottom section, and have then experienced a further marked increase in signal strength reports. This improvement may in part be due to raising the coil into an unscreened position clear of the car body, and some light may be cast here by experiences the author has had when transferring a particular installation from a saloon to a "soft-top" convertable. Although in the latter case the coil height above a rear-bumper mounting was less than previously, and the measured current at the base of the whip also some 20 per cent. lower, due no doubt to less capacitance to ground, signal reports averaged an increase of two S points.

It is difficult to find any explanation of this advance other than the removal of the loading coil to greater distances from the metal body of the car. Other Amateurs have confirmed corresponding results, and there seems evidence that it would be necessary to move the aerial to a position well above a saloon car roof in order to gain equivalent performance.

A golden rule there emerges, and this is to place the coil high and clear for outstanding results. This step will tend to help in other directions also, as it will keep the coil clear of radiation from the car itself, from passing vehicles, and from other surrounding disturbances. The reaction of these experiences upon the general belief that most radiation comes from the lower portion of the mobile system where current is greatest, and that both the coil and top section of the whip do not contribute a great deal, has long worried the author, as conflicting facts constantly seem to crop up. G5IC has pointed out that resonant-circuit theory demands that the current into the base of any loading coil and that out of the top must be equal. This current will taper off along the top section as it is dispersed through the capacitance of this section to ground, or more properly to the car body, but radiation must be important from at least the lower part of it. This component of radiation will tend to be a constant factor, but it is understandable that its contribution will increase with height above ground.

Light is also thrown upon the claim often seen in American publications that a capacity hat at the **top** of an aerial, which will tend to increase r.f. current throughout the whole top section, is a desirable factor, whereas the experience often reported in this country that a hat located immediately above the loading coil does not seem a good proposition is also logical, since at this point it will tend to remove most of the current from the whip above it. It is thus unfortunate that a hat near to the top of a mobile system is so unsatisfactory from the view point of wind resistance and mechanical stability, as electrically it is a favourable design feature at the lower frequencies.

When operating "fixed mobile" or portable with the mobile equipment, and with sufficient time to make such modifications, both the author and many others have found it most effective to add bottom sections to the aerial so as to raise the loading coil to a considerable height. When this is done, there will be an increase in the resonant frequency, resulting from the lowered capacitance to earth, and this can be corrected by the addition of a light capacity hat at the extreme top of the system. When lengthened in this way the mobile aerial becomes flimsy, and light nylon guys may be added. These should be attached at a point immediately below the coil, where the r.f. potential is relatively low, and losses will not be introduced. When operating on the h.f. bands the problem becomes different, for the added length becomes significant in terms of wavelength, and may predominate to the extent that coil inductance will require reduction. The required tuning effect can be achieved by reducing the length of the top section, although this is far from convenient!

Under portable conditions there are two interesting additional modes in which the mobile aerial can usefully be employed. In the first place, a quarter-wave aerial will resonate as a half-wave aerial adjacent to the next higher-frequency band, and can be used in this way if a high impedance a.t.u. is available at the base. Thus a 1.9 MHz. loaded whip will resonate in the region

of 3.8 MHz., and will require a small amount of base loading to trim it into the 80 metre band.

The author has used this arrangement effectively, adding a small rotary coil at the base of the system and coupling into the equipment from a link winding slipped over this coil, thus retaining a low impedance feed out of the transmitter. The arrangement is convenient as an 80 metre receiving aerial, when another aerial is used for transmission, and can be coupled into most receivers having a medium impedance input by means of a small capacitor from the top of the rotary coil. If the base loading coil is earthed, the whole system can be resonated as a three-quarter-wave system, and a 75 ohm feeder at the bottom may be retained. This technique is applicable in the case of the 7 and 21 MHz. bands, having a frequency ratio of three to one, because an aerial adjusted for current feed in the usual mobile manner for the former will also function on the latter.

The second mode which is useful both under mobile and field conditions arises from an appreciation that the lower section of such a system up to the base of the coil can be current-fed as a quarter-wave vertical radiator without changing the feeder connection, the coil acting as an isolating choke. Thus if the lower section be made 8 or 12 ft. in length when portable, it can be loaded for the 10 or 15 metre bands. A more interesting possibility when mobile would be a bottom section of some 40 inches which will permit operation on 4 mx from a top band or 80 mx whip without alteration. No doubt the coil design will play a part in getting the best from such an unorthodox arrangement, and should have minimum losses and self-capacitance, but these requirements are essential for a good loading coil in any case.

DESIGN CRITERIA FOR LOADING COILS

The design of loading coils for the lower frequency bands has been a cause of concern to the author for many years, since in no part of the mobile system is so much variety seen, and some of the most successful designs appear to run contrary to published theoretical treatments which invariably stress the need for high Q as the principal requirement. In fact, the general view seems to be that if the coil is of the correct inductance, and has maximum Q, there is little more which can be done.

That the coil should be of low loss construction and minimum h.f. resistance is undoubtedly true, as pointed out under heading (c) initially, and this is implied in a high Q factor. It is also well established that the coil should have the minimum possible self-capacitance, and can with advantage be of sectionalised design, as r.f. current flowing through the self-capacitance plays no part in producing radiation but tends to promote power wastage.

When consideration is given to coil dimensions, however, an anomaly appears. Most experienced mobile operators agree that a high r.f. potential across the ends of the coil is one criterion of good performance, and proudly demonstrates the distance away from the whip at which a neon lamp can be struck by the electrostatic field. They also agree that comparatively long coils, having a ratio of length to diameter of perhaps six to one, are much the best, particularly on the lowest frequency bands; winners of many past rallies and competitions are emphatic on this point. But it is common knowledge from any text book that to arrive at the maximum Q a coil must have a good "form-factor", namely a ratio of length to diameter in the region of 0.4, because this short, wide shape results in the shortest length of wire and the lowest r.f. resistance for a given inductance. But those who have tried coils of this form agree that the results are far from impressive, so it would appear that some of the factors which go to provide a high Q are desirable, but not all.

The author is prepared to hazard the view that Q is, in fact, not the most appropriate factor by which to assess a mobile loading coil, and would support this by pointing out that all the leading commercial aerials from the G3FIF to the Webster Band-spanner have comparatively long thin coils, which cannot have the best Q obtainable, and which in some cases do not appear to have particularly low-loss construction. Most of the leading American products for the h.f. bands do appear to pay full attention to this aspect. Accepting therefore that low r.f. losses are of the usual recognised importance, it is perhaps important to remember that the coil forms one part only of an aerial system having several other sources of resistance, the most important of which at the lower frequencies is certainly the series-earth loss.

If it be accepted that the mobile system is completed by the capacitance of the vehicle to true ground, in which the electrical image of the aerial can be thought of as existing in high resistance earth below the car, this will be a very "lossy" capacitance representing a series resistance much higher than that of the coil. This view is borne out by the well established fact that the h.f. mobile performs at its best when over wet or highly conductive ground, as for example when near to the seashore. As part of such a high-loss system the difference in coil resistance due to the form-factor may well be negligible, and the optimum shape may be determined by other considerations.

After much discussion on this subject a valid explanation on fundamental grounds seems to have been arrived at from a reversion to first principles. From the original equations of Clerk-Maxwell it is well known that any radiated field in space has both an electrostatic and an electromagnetic component, and that these must be correctly related. It is common experience that neither field component alone will produce radiation. For example, the intense electrostatic field between the electrodes of an r.f. dielectric heater dissipating many kilowatts fortunately produces comparatively little radiation. Similarly, the electromagnetic field of a tank coil carrying equally heavy r.f. current is not an effective radiator—no one expects to transmit far on a loop aerial. In both instances the available power is mainly dissipated as heat. Both field components must be present in the correct proportion for radiation to occur.

In the typical mobile whip it is accepted that current flowing mainly in the lower section generates a magnetic field. This will not be radiated, however, unless an adequate electrostatic component is also present in the form of an r.f. potential difference between the ends of the conductor carrying this current, namely the base and tip of the whip. Since the aerial is a resonant circuit, these components will be in the required phase relationship. However, there is very little potential gradient along the open portions of the whip, which are small in terms of wavelength, and the major part of this essential p.d. will appear across the ends of the coil, as is normal in any parallel-tuned circuit.

The electrostatic field strength set up will be proportional to the distance apart of these two high potential points, namely to the length of the coil, since 100 volts (for example, across one metre represents an electrostatic field

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The Labgear h.f. mobile aerial type LTA10 is a continuously tunable aerial designed to have a nominal frequency coverage of approximately 2-15 MHz. However, the height above ground, the ground plane effect of the vehicle, the position of mounting, etc., all contribute to small changes in the end limits of frequency to which the aerial will tune with a given transmitter.

Allowing for these environmental factors, experience has shown that under typical working conditions the available tuning range should be regarded as 2.25 MHz. to 12.5 MHz. and every aerial is checked at these limits.

The motor section, not shown, is made to fit in the boot of a car, and the mounting bracket and suspension assembly consist of a number of castings and a pair of springs and hydraulic dampers. The control unit should be fitted as close to the equipment control panel as possible.

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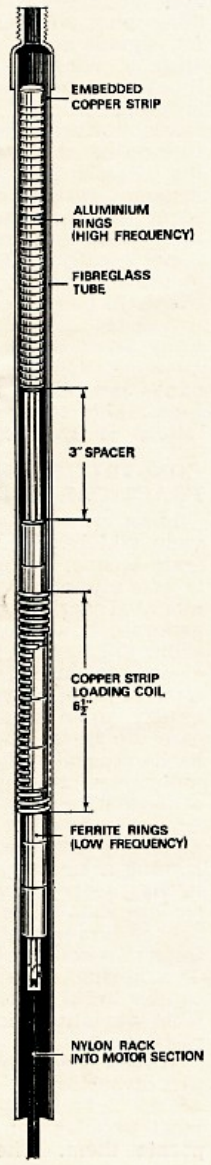

of 100 volts-per-metre, while if it were across one centimetre, the same p.d. represents only one per cent. of this field. The conclusion therefore seems inescapable that however strong an electromagnetic field component there may be, it can only be fully transformed into radiation rather than heat if an adequate electrostatic field is present, and vice-versa.

In practical terms, there must be a minimum length of coil before full radiation becomes possible, and in fact there will be an optimum length for any particular system above or below which efficiency falls. No doubt this could be shown mathematically to correspond to a maximum radiation resistance. For an average top band aerial this length appears to be in the region of from 12 to 18 inches, and is a much more important factor in a good overall design than high Q if the latter be obtained at the expense of this dimension. No claims of exceptional performance from considerably longer or shorter coils can be traced, although the latter may be recommended on grounds of convenience.

DESIGN CONCLUSIONS

It now seems possible to summarise the design requirements for a good h.f. mobile aerial. The loading coil must be relatively long, and of good low-loss construction, but can be of small diameter with an overall advantage if the resulting reduction in wind resistance and weight permit a higher mounting position. The top whip section is not of prime importance, but as an overall height of 12 to 13 ft. above the road is perhaps the maximum for safety, it is better to make this not more than 4 ft. of ½ in. or ⅝ in. diameter tubing rather than long and thin, so that the coil can be proportionally higher. The use of a telescopic whip for tuning purposes is most unwise in the author's view, for after a very short life it will become noisy and unreliable through weathering. A large diameter whip will exhibit a greater capacitance to earth per unit length. Less length is thus needed to resonate any particular loading coil, permitting the coil to be mounted higher without excessive overall height; alternatively, a coil of lower inductance having less r.f. resistance could be used. In either case efficiency is improved.

The lower section of the aerial should be of low resistance, 1 in. diameter tubing being a good compromise between weight, strength and other considerations. The coil is sometimes stated to need no protection against rain, if it is well varnished and of waterproof construction. This may be reasonably true for top band systems, as the leakage path along the coil is considerable, but in the author's experience rain lying between the turns can greatly increase losses at higher frequencies, and the coils should be protected. A layer of p.v.c. tape over the dry coil appears to be perfectly satisfactory. Many forms of coil cover can be devised, but unless the coils are sealed in a dry, inert gas, as are some of the best commercial products, the cover must not be sealed, for condensation will eventually occur. A good practice is to leave the cover open at the bottom.

POSITIONING AN H.F. AERIAL

Position of the aerial on the vehicle is important, perhaps the overriding factor at h.f. being a clear position for the coil. The advantages of the central roof position have been stressed, particularly at v.h.f. In the U.S.A., where convertibles are widely used, a rear bumper mounting is favoured. It can be excellent on suitable cars, but as applied to all-metal saloons there is a probability of the coil coming too close to the bodywork. Furthermore, while the aerial is well clear of the car's own ignition and electrical system, it is liable to pick up maximum interference in traffic from following vehicles. In general, aerials in this country should be mounted on the off-side of the car, as this places them furthest away from overhanging trees and road-side interference.

The conventional position on the off-front wing, favoured for broadcast aerials, has been shown to be quite effective, but work carried out in America by K5CFW has shown this position to be surprisingly directional. Of course there are few positions at which an aerial can be mounted on a saloon car and be free from quite pronounced directional effects. There is a tendency for signals to be concentrated forward with a wing-mounted aerial, and to the rear when rear bumper mounting is used. In all cases the radiation is lowest towards the sides of the vehicle, confirming the idea that the length of the chassis is frequently part of the resonant system, and nulls can in fact occur in the broadside directions. The directional pattern of an installation is not greatly dependent upon frequency in the h.f. bands, and maximum radiation is to be expected in the direction of travel, a little towards the near side **away** from that on which the whip is mounted. On the 10, 15 and 20 metre bands the effect of turning the car was comparable to many beam aerials, variations of up to 20 dB. being common.

CONSTRUCTION— PRACTICAL CONSIDERATIONS

Ideas on aerial construction naturally vary widely, but tend to follow three main trends. A light, rigid construction is often possible at v.h.f. or for roof-mounted aerials of limited height. In general, however, it is necessary in order to cater for high road speeds either to introduce flexibility into the system, or alternatively to mount a rigid system upon a flexible base. In this case the aerial may be expected to lean backwards at quite large angles during motorway cruising, and this has been criticised on grounds of detuning. American practice favours a stiff spring mounting for the rear bumper, where leaning is unlikely to be dangerous, but it has been advised that the usual spring should be covered with thick rubber tubing such as hosepipe, in order to damp out mechanical oscillations. The spring should be bypassed with copper braid in order to eliminate possible variations in inductance and h.f. resistance.

W4QS is emphatic in condemning the use of springs of any type in any part of the mobile aerial system, although most popular commercial whips incorporate them. The author has used a spring mount for many years without detecting any adverse consequences, and mechanical failures have not occurred. However, the aerial feed is taken to a point **above** the spring mount which is also insulated at the lower end, and thus the spring does not form part of the lower whip section. This would seem to get round any electrical objections.

Detuning as a result of the whip leaning does not appear serious at the lower frequencies, but may be expected to increase towards h.f. as lower portions of the aerial become relatively "hot". The DX operator should therefore be particularly alive to this risk, and it is always most unwise to employ a very flexible or "whippy" top section, as this will cause an unpleasant wobble in tuning and signal strength. A slightly flexible construction throughout such as is obtainable from the use of fibreglass, has much to recommend it, and it is unfortunate that so little has been published regarding the effectiveness of helically-wound fibreglass whips, although a design claimed to perform well on 7 and 21 MHz. has been published by G3FPK, and the American commercial "Heliwhip" for 10, 15 and 20 metres has been well reviewed.

It seems probable that this construction, which combines lightness, strength, low wind resistance and a degree of flexibility, can be excellent for those bands on which limited inductive loading is needed. At lower frequencies, however, it is difficult to obtain sufficient inductance on such a small diameter without the use of fine wire having relatively high resistance, and losses tend to rise. A construction has been proposed in which the lower few feet of such a whip is wound with an open helix of heavy wire, followed by a close-wound section corresponding to the usual centre-loading coil, continuing with an open helix of fine wire to the tip. The G3FPK design employs a winding-pitch which is progressively reduced towards the tip, so that the greater part of the r.f. resistance will be in the upper part of the whip where current is lowest. This construction is also claimed to raise the feed point impedance.

TUNING H.F. WHIPS

Mobile whip aerials are normally regarded as equivalent to quarter-wave verticals, having maximum current and minimum impedance at the feed point. There is evidence, however, that many successful designs are in fact slightly longer than a quarter-wavelength electrically, thus raising the resistive component of the feed point reactance towards 75 ohms, and the current maximum is partway up the aerial where it will be more effective. This is almost certainly the case when bottom-loading or trimming is employed, or when the feeder is tapped up along a base loading coil or Z-match. The author has made no reference to this form of coupling, because in his experience, with which not all experimenters agree, no advantage has ever been noted from any kind of impedance-matching device in relation to an aerial which is correctly matched in its initial design. Such arrangements are convenient in main-

taining loading when tuning over a band, but they cannot be without their own inherent r.f. losses, and the gain may be more apparent than real.

It is worth bearing in mind, however, that whips can be designed for half-wave resonance, which will place the maximum current well up in the clear, and fed from a high impedance coupling unit. The helical construction, for example, can be wound with close-spacing at both ends, and a heavier gauge open section in the centre; the construction is quite practicable for the higher frequencies and might be expected to give very interesting results.

It has been stressed by many authors that really low-loss construction is vital for the mobile loading coil, and while pointing out the importance of correct proportion, the author fully endorses this viewpoint. It is claimed with good reason that only individual, interchangeable coils for each band can provide this peak efficiency, and W4QS, for example, states that up to 3 dB. gain, representing double the effective radiated power, is obtainable over any form of tunable construction. However, there is little doubt that many mobiles feel the need for a multi-band system, particularly when DX operation is required, and will accept some penalty for this convenience.

At v.h.f., as has been suggested, interchangeable whips are satisfactory or it is possible to introduce a telescopic feature if the greatest care is taken to keep all sliding joints clean and firmly clamped. On h.f., however, it is not possible to change bands by length adjustment or capacitance loading alone, and the coil inductance must be varied. The problem becomes the familiar one of doing this without the introduction of excessive r.f. losses. Tuning within the band can be carried out by: (i) sliding a capacity hat along the upper section, (ii) by hinged rods, or (iii) by a small telescopic extension fitted at an angle to the whip just above the loading coil.

The best known solution is undoubtedly that used in the Webster Bandspanner in which movement of the top section adjusts a sliding contact along the **inside** of a well protected loading coil. This is not an easy form of construction for an Amateur to attempt himself, and other approaches such as tapped coils or the variometer principle have been used with varied success. All such systems have the disadvantage, however, that the car must be stopped and the aerial manhandled, perhaps in pouring rain, in order to change bands or even to change frequency within the limits of one of the wider bands. It should not prove beyond the reach of Amateur ingenuity to find a solution whereby band tuning or even band changing can be carried out from the driver's seat, and it seems that the modern ferrite materials should offer a promising approach.

G2BCX has described the use of a small piece of grade B2 ferroxcube rod slid within the lower portion of a top band loading coil as a satisfactory means of tuning over the band, stressing the importance of avoiding saturation by the r.f. field, but has not referred to the remote actuation of this rod. The author has made considerable use of the latest ferrite materials in the construction of r.f. coils, including tank-coils handling the range of power levels in general mobile use, and while there are, of course, losses and the core material may become warm, he is of the opinion that these losses are not necessarily serious in relation to others which are always present. The experiment of moving a relatively large ferrite core longitudinally by means of a Bowden-wire control has been tried, and it has proved feasible to tune a mobile aerial remotely from 3.8 to 1.8 MHz. by this method with tolerable performance. Losses are, of course, a minimum at the h.f. end, where the effect of the core upon inductance is small. This makes possible efficient working in the 80 metre band, and an instant change to top band without leaving the car. It is possible to visualise the movement of a combined copper-ferrite slug within a helically-wound hollow fibreglass tube, having suitably graded windings whereby the effect of the ferrite will become greater as it is moved into regions having closely-spaced turns.

A still more flexible solution may lie in an application of the transductor principle, in which the inductance of a coil is varied by the saturating effect of d.c. passed through a control winding. If this could be developed at radio frequencies through the skilful use of modern materials, without the introduction of too large losses as a result of core saturation, aerial tuning could be altered by the adjustment of a simple potentiometer on the dashboard. The varactor diode clearly offers another similar approach, but here there is a problem in that any form of parallel tuning capacitance has been shown to ruin the performance of mobile aerials. However, little or nothing appears to have been done with the idea of varying the tuning or current distribution by means of series capacitance, and there seems no reason, on basic grounds, why this method should not be feasible.

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The Bantex h.f. aerial type MI was developed in the U.S.A. for s.s.b. transceivers and is made in the U.K. exclusively by Bantex Ltd. It is a helical aerial covering the range 3-15 MHz. It is made in 15 different models covering this band and has found widespread acceptance in application where only a few frequencies are used, eliminating the necessity of an expensive aerial tuning unit.

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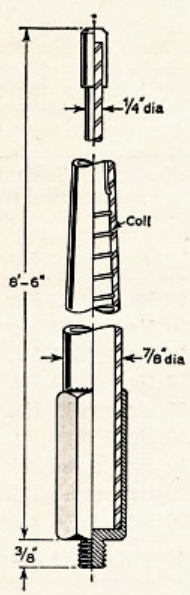

"HOW MANY Hz. IN FREQUENCY?"

DAVID RANKIN, VK3QV*

How many Hz. in frequency? Orthographically speaking of course there are none but read on to learn how many there can be in some electronic circumstances. By the way, if you do not know what "orthographically" means, this article will not tell you. Try your dictionary.

THE BEGINNING

Recently a friend of mine purchased some crystals for his new solid state f.m. carphone. But when he received them and started out on the installation his troubles began—he could not get the crystals to come up on frequency. The receiving side was not too bad, but the transmitted signals were quite a few kHz. off channel and no amount of fiddling with the trimmers would bring the crystals within cooee of the wanted frequencies.

What had gone wrong and why?

There are a number of reasons why a crystal does not oscillate precisely on its marked frequency and most of these were covered recently by an article in "Amateur Radio".[1] However, from the friend's experience cited above, one more reason comes to light. This involves the way of specifying the crystal frequency and a few words on this subject may save others from expensive mistakes and omissions.

THE PROBLEM

Many of the popular carphones in the 146 MHz. f.m. band use Tx crystals around 4 MHz., so let us concentrate on this frequency initially and expand our discussion to other frequencies later. A 4 MHz. crystal unit for the Tx implies a multiplication factor of 36 times.

Thus: 146,000.0 kHz. ÷ 36 = 4055.555 kHz. (the five in other words is recurring).

We could thus say we need a crystal on 4055 kHz., or on 4055.5 or on 4055.6 or 4055.55 kHz., etc. Just how should we specify the frequency or "How many Hz. in frequency?" (Get it?) If we say the frequency is to be 4055 kHz., then we are actually 555.55 Hz. off the calculated frequency, and that multiplied 36 times puts us just about 20 kHz. away from 146 MHz.—too far away to be of any use to anyone.

On the other hand, if we say the frequency of the crystal should be 4055.55555 kHz. then we would be too academic because who among the Amateur ranks (and the professionals for that matter) can precisely measure carphone frequencies to 0.01 (one hundredth) of a Hz.? What purpose would such accuracy serve? No doubt the crystal manufacturer would smile at such a request and ignore the last few digits in your frequency spec., anyway. Obviously then, there is some middle course, but what is this happy medium and how do we determine it?

Referring again to the recent "Amateur Radio" article,[1] we saw how the frequency adjustment tolerance affected the final outcome and before we can answer the question about the happy medium we must look at this tolerance because it plays an important part in the number of figures we should quote in a frequency.

ADJUSTMENT TOLERANCE

Let us consider two points in reference to this tolerance.

(a) In scientific circles, a concept of "order of magnitude" is used. Simply, if a measurable event is said to be affected by a condition of "one order of magnitude" less than the event, then, initially at least, the effect of the condition is regarded as being negligible and may be disregarded. On the other hand, if the condition is of an "order of magnitude" greater than the event, then the effect of the condition is significant and it cannot be disregarded. For most practical cases, the "order of magnitude" is considered as being a factor of ten times and we will use this concept here. We will, in effect, consider a variation of 1/10th in our tolerance figures to be of negligible importance with respect to the nominal frequency.

(b) What is the tolerance in terms of Hz. for varying percentage tolerances typically offered by crystal manufacturers? At 4 MHz., the following would apply:—

a tolerance of ±0.01% is ±400 Hz.
and ±0.005% is ±200 Hz.
and ±0.003% is ±120 Hz.
and ±0.0015% is ±60 Hz.
and ±0.001% is ±40 Hz.

Let us now apply our "order of magnitude" concept to these tolerance figures.

±400 Hz. → ±40 Hz.
±200 Hz. → ±20 Hz.
±120 Hz. → ±12 Hz.
±60 Hz. → ±6 Hz.
±40 Hz. → ±4 Hz.

} may be considered as a negligible variation.

Thus, if we have an allowable tolerance of ±400 Hz. and if we quote our actual frequency to within ±40 Hz., then we can say that we are specifying this frequency to a sufficient degree of accuracy consistent with the adjustment tolerance desired. Obviously, if we want a tighter tolerance we must be more precise about our frequency specification and this follows from our example viz.: for an allowable tolerance of ±40 Hz. we should quote our frequency to the nearest ±4 Hz.

FREQUENCY SPECIFICATION

The recommended method of specifying the digits of 4 MHz. crystals now becomes:—

For a ±0.01% tolerance—quote the frequency to within ±40 Hz. of nominal frequency.

For a ±0.005% tolerance—quote the frequency to within ±20 Hz. of nominal frequency.

* 1879 Malvern Road, East Malvern, Vic., 3145.

Frequency kHz.	Adjustment Tolerance (as stated) in terms of Hz. with recommended method of Frequency Quotation		
	For ±0.005% (±50 p.p.m.)	For ±0.003% (±30 p.p.m.)	For ±0.001% (±10 p.p.m.)
2,000	±100 Hz. → Quote to nearest 10 Hz.	±60 Hz. → Quote to nearest Hz.	±20 Hz. → Quote to nearest Hz.
4,000	±200 Hz. → " " " 10 Hz.	±120 Hz. → " " " 10 Hz.	±40 Hz. → " " " Hz.
8,000	±400 Hz. → " " " 10 Hz.	±240 Hz. → " " " 10 Hz.	±80 Hz. → " " " Hz.
10,000	±500 Hz. → " " " 10 Hz.	±300 Hz. → " " " 10 Hz.	±100 Hz. → " " " 10 Hz.
20,000	±1 kHz. → " " " 100 Hz.	±600 Hz. → " " " 10 Hz.	±200 Hz. → " " " 10 Hz.
30,000	±1.5 kHz. → " " " 100 Hz.	±900 Hz. → " " " 10 Hz.	±30 Hz. → " " " 10 Hz.
40,000	±2.0 kHz. → " " " 100 Hz.	±1.2 kHz. → " " " 100 Hz.	±40 Hz. → " " " 10 Hz.
50,000	±2.5 kHz. → " " " 100 Hz.	±1.5 kHz. → " " " 100 Hz.	±50 Hz. → " " " 10 Hz.
60,000	±3.0 kHz. → " " " 100 Hz.	±1.8 kHz. → " " " 100 Hz.	±60 Hz. → " " " 10 Hz.

Table 1.—Recommended method of frequency specification in range 2.0 to 60.0 MHz. and for tolerances of ±0.005%, ±0.003% and ±0.001%.

For a ±0.003% tolerance—quote the frequency to within ±12 Hz. of nominal frequency.

For a ±0.0015% tolerance—quote the frequency to within ±6 Hz. of nominal frequency.

For a ±0.001% tolerance—quote the frequency to within ±4 Hz. of nominal frequency.

However, we can take this idea a little further, and in doing so, make its practical application a little simpler. It is not particularly convenient to quote a frequency within ±40 Hz., but because of our decimal system of arithmetic, quotation to the nearest ±10 Hz. is quite simple—just leave the digits following the 10 Hz. digit out although we should observe the normal arithmetical laws concerning "rounding off".

e.g. rounding off ...65.432 to two decimal places becomes ...65.43, whilst ...34.567 becomes 34.57 to two decimal places.

Thus, the recommendation above simplifies to:—

For

±0.01%	types	specify	within	±10 Hz.
±0.005%	,,	,,	,,	±10 Hz.
±0.003%	,,	,,	,,	±10 Hz.
±0.0015%	,,	,,	,,	±1 Hz.
±0.001%	,,	,,	,,	±1 Hz.

In other words, we should specify our 4 MHz. crystal as—

4055.56 kHz. if we require it to be manufactured within ±0.01%, ±0.005% or ±0.003%,

and as 4055.556 kHz. if we desire ±0.0015% or ±0.001% adjustment tolerance.

Two observations—

In the case of recurring decimals, round off to the nearest figure for the last digit quoted.

The compromise suggested is on the conservative side and will mean that the frequencies specified will be a little more precise than need be.

It becomes a relatively simple matter to extend the idea to other frequencies and Table 1 shows the results for adjustment tolerances of ±0.005%, ±0.003% and ±0.001% and for frequencies between 2.0 and 60.0 MHz. Readers should do their own calculations for tolerances and frequencies not covered.

Table 2 summarises the actual frequencies used in the most popular carphone configuration for the three simplex f.m. channels currently used in Australia. An adjustment tolerance of ±0.003% has been used as this is considered a suitable compromise between convenience and cost. A tighter tolerance crystal may cost more money, but it should be easier to net to frequency because the actual manufacturing tolerance is less and the crystal will be manufactured closer to nominal frequency within the terms of the actual specification.

CONCLUSION

We have set up a technique for specifying, with the appropriate number of digits, the frequency of a quartz crystal. Although our discussion centered around Tx crystals, the technique is equally applicable to Rx crystals and in addition can be used for specifying crystals for any purpose—not just f.m. equipment. The decisions you must make concern the actual frequency required plus the permissible adjustment tolerance—the numbers of digits in the frequency sepecification will then follow from the idea presented here.

By the way, the friend mentioned in "The Beginning" got into trouble because he had only specified his crystal frequencies to the nearest kHz.—and in this case "near enough" was not "good enough".

Finally, the author makes no claim to fame as an orthographer—just as the Editor.

TRANSMITTER CRYSTALS

Formula (f_c = Carrier Frequency)	145.854 MHz. Simplex	146.000 MHz. Simplex	146.146 MHz. Simplex
$\frac{f_c}{36}$	4,051.50 kHz.	4,055.56 kHz.	4,059.61 kHz.
$\frac{f_c}{24}$	6,077.25 kHz.	6,083.33 kHz.	6,089.42 kHz.
$\frac{f_c}{12}$	12,154.50 kHz.	12,166.67 kHz.	12,178.84 kHz.

RECEIVER CRYSTALS

Formula (f_c = Carrier Frequency)	145.854 MHz. Simplex	146.000 MHz. Simplex	146.146 MHz. Simplex
$\frac{f_c - 2.0^*}{14}$	10,275.29 kHz.	10,285.71 kHz.	10,296.14 kHz.
$\frac{f_c - 10.7}{3}$	45,051.3 kHz.	45,100.0 kHz.	45,148.7 kHz.
$\frac{f_c + 10.7}{3}$	52,184.7 kHz.	52,233.3 kHz.	52,282.0 kHz.

* Simplified version of actual formula used by manufacturer.

Table 2.—Recommended method for quotation of crystal frequencies for Australian FM channels based on a crystal adjustment tolerance of ±0.003%.

N.B.—Only some of the more popular formulae are included in this table. Interested readers should be able to calculate frequencies correctly for other cases.

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SKEDS AT SEA

Cyclone "Althea" certainly created havoc on land at the end of Dec. What would it have been like on the high sea? At about that time Ralph Martin, VR4BM was yachting in his trimaran "Seeker" from Honiara in the Solomons bound for Rabaul. He didn't make it and was forced to return. Read his account. "The first part, from Honiara to Gizo, was routine, Morova Lagoon on New Georgia was delightful but then the wx began to deteriorate. We had a nasty passage with a heavy rain squall at the end just as we were going through the pass in the reef. It was down sail and start the motor. I shudder to think what would have happened if the motor had been in the condition it was a few days later. Visibility was down to 100 yards until we anchored off Munda."

Talking to an aircraft pilot next day, he heard about a cyclone some 200m. S.E. No wx reports could be obtained and as conditions did not get worse he decided to carry on after keeping sked with Stan VK2BSG. Three restful days were spent in Gizo and he then left for the Shortlands but whilst clearing the reefs the motor began to fail. They reached the Shortlands vicinity but never made it due to strong winds followed by a flat calm with a current taking them onto the outlying reefs. The motor then failed completely, so they used the dingy and oars as tow until the wind came in again. Hard sailing put a safe distance between them and the reefs, but to carry on to Kieta whilst bucking the N-W monsoon, with no motor and unfamiliar reefs ahead, made them decide to return.

"The voyage back to Honiara was when we really appreciated Amateur Radio. Our nightly skeds (with Stan) were the high point of the day. The moral support of knowing that there was someone at the other end waiting to hear was what we needed most."

The night they obtained a relay of the wx report from Stan in Sydney was their worst. As they finished the sked a severe squall hit them, followed by calm. "There was a lot of lightning about and in one of the flashes the islands (the Russells) showed so clearly that it looked like a zoom lens bringing them closer. We were in a dead spot at the time and I had everything up trying to work with whatever small breezes were around.

"There was a dark patch in the sky off to the west. It seemed a long time coming. On a hunch sails were shortened, but when it hit us it was a grand-daddy. The working jib was too much but I did not dare try to get it off. The squall held for hours and still blew at dawn with gusts about 50 knots. Whoever has to do this (near a lee shore) should try to get the wx man to give latitude and longitude of the centre."

Others drawn into the drama included Lloyd VK2BLK, Jack VR4EE, Selwyn VR4BS, YJ8DS and VK4UG for relays. The wx improved, the cyclone turned off to the south, and they finally returned safely to Honiara.

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TRADE NEWS

R. H. Cunningham Pty. Ltd. announce the release by their principals, Kilovac Corp., of a new rugged high voltage, high current, vacuum relay listed as the KC-10. Capable of withstanding 15 kv. d.c. to 60 Hz. peak up to 75 amperes, this s.p.d.t. ceramic relay is the latest in metal-ceramic technology.

Commercial Kinks

This month sees the start of a brand new feature series in our journal. For some time it seems as if we have been in need of a column that caters for the interests of the much-maligned—the appliance operator. To be realistic most of us come under this heading, perhaps some of us only to a small extent, but commercially-made Amateur gear is of vital interest to us all. Even to those of us gifted enough—and of course with the time available—to construct our own gear, a knowledge of current commercial practice is quite invaluable.

It is hoped in future this column will give a monthly rundown on useful hints, modifications and other advice on transceivers, receivers, transmitters and any other items of gear that may be of general interest. The writer is also looking into the possibly of publishing a series of technical reviews on new equipment as it becomes available. Perhaps, too, readers might like to participate by letting me know about problems they might be having with their own station gear, or of any modifications they have made or would like to make.

Not to be all one sided, I would like to start off by making an offer to the reader. Over the years I have built up a fair collection of information, circuits, etc., on all types of Amateur equipment including some of the more popular disposals items. If you are in need of a circuit or perhaps some modification data, drop me a line c/o. "A.R." and I will be happy to help—if I can. At the time of writing, it looks as if the cost of copying an average circuit will be about 20 cents plus postage, however I suggest you write to me first and I will let you know if I have the information you need. **Do not forget a s.a.e.**

THE DRAKE 2B RECEIVER

No doubt all Drake 2B owners read with interest the 160 metre conversion article in Nov. 1971 "A.R." Believe me, it works like a charm. I got to work and converted my 2B in just about no time at all with first-class results. If you have not already done yours, here are a few hints that I am sure will help.

The 750 pF. trimmers mentioned in the article are not available in this country. The biggest I could find was 220 pF. Now if you parallel one of these with a 1200 pF. Styroseal capacitor, the circuits will tune up with about half the capacity of the trimmer. The author's estimate of 1500 pF. required seemed to be on the high side.

For the crystal I used one on 5.5 MHz. which gives an overall tuning range of 1.4 to 2.0 MHz., however the preselector tuning will peak only over the 1.8 to 2.0 MHz. range. The 5.5 MHz. crystals incidentally are commonly available from stock, as these are used as markers in t.v. sweep generators.

The whole job of converting the 2B only takes about 10 minutes, so go to it and enjoy some 160 metre listening for a change.

OLD RECEIVERS AND S.S.B.

S.w.l. friends and Amateurs often ask what they can do to improve s.s.b. reception on older receivers such as the BC348, AR7 and some of the earlier post-war models.

There are of course many answers to this question, probably ranging from a complete re-build down to many simple changes. Many of the factors required by an Amateur or even considered normal by him may not really be necessary for an s.w.l. Stability and selectivity cannot usually be improved beyond points that would fall well behind modern s.s.b. gear.

Probably the one thing that is most annoying in old receivers is the lack of an effective a.g.c. system. I have found that in most cases an audio-derived a.g.c. comprising one valve or a couple of transistors plus a couple of diodes built on a small sub-chassis will really make an old set perform on s.s.b. A product detector is not needed.

Next month we will continue this with a few suitable circuits for audio derived a.g.c. plus a few hints and modifications on some of the more popular s.s.b. transceivers.

OVERSEAS MAGAZINE INDEX

Accessories: (1) "An Audio Tape-Controlled C.W. Keyer". (2) "Zero-Beat—Visually". (3) "Wide Range R.F. Millivoltmeter using Hot Carrier Diodes"; "An Instant F.M. Repeater for Emergency Use"; "'It'—It's the Real Thing", economy power supply (very handy for the average transceiver; some diodes could probably do with a better safety factor though); "A Simple Reverse Current Battery Charger" (VK3ASC is still not convinced of its effectiveness on dry cells. Any comments from readers will be appreciated!). (6) "Crystal Tester—Calibrator"; "Class A Audio Amp." (15-20w. output). (8) "A Relay Driver for use with Solid State Keyers"; "The W7YGN Contest Keyer".

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Other: (3) "Meteor Showers on Prediction Accuracy"; "Simple Digital Remote Control Circuits". (5) "Adjustable H.T. Power Supply"; "Vehicle Noise Suppression for Mobile Operation"—very complete and applicable particularly to the Morris Minor 1000; "Beam Direction Indicator". (7) "V.H.F. F.M. Channel Scanner"; "V.H.F. Co-axial Filter"; "Easy to Build IC Function Generator"; "Low Cost 'Instant' Printed Circuit Boards"; "A.C. Power Line Monitor". (8) "Transverter for 1.8, 21 or 28 MHz."—driving transceiver is on 3.5 MHz.; "Fabrication of Printed Circuit Boards"; "How to Make a Jewish Movie"—the experiences of a Hollywood Ham in Israel; "Radio Robert"—a 1925 story of radio in a logging camp.

Receiving: (1) "A Simple IC F.M. Detector"; "The Motorola 80D on 225 MHz. Part 2 Rx"; "An IC Pre-Amp. for 6 Metres". (2) "A Different Approach to Front-End Design"—double conversion with a single local osc. (4) "Using the SL630"—a Plessey IC for a.f. stages. (8) "Two New ICs for the Receiver Builder"—these are R.C.A. types.

Transmitting: (1) "Build a 50w. 1934 Style Transmitter for Fun"; "F.M.—Building a Phase Modulator for A.M. Gear". (2) "Sideband with the Ranger"—modifications to the popular Johnson Viking Ranger a.m. tx to d.s.b.. (4) "A Transmitter for 28 MHz. with Class D Modulator"—solid state; "A Stable V.F.O. for 2M with F.M." (5) "813s in Linear"; "Transmitting Antennae for Small Gardens—the helical whip on top band. (5/6) "Personal Portable for Two Metres"—Pt. 1 in (5), Pt. 2 in (6). (6) "VXO for 2 Metres"; "Build up of a Transmitting Layout," Pt. 2; (Pt. 1 Sept. issue). (7) "R.F. Clipper for the Collins S Line"; "High Performance 144 MHz. Power Amplifier"—1000w. c.w. to a 8877. (8) "A C.W. Man's Kilowatt," Pt. 1—240w. into parallel 6146Bs.

KEY

(1) "CQ" Nov. (2) "CQ" Dec. (3) "73" Oct. (4) "Radio Comm." Oct. (5) "Short Wave Magazine" Oct. (6) Ditto Nov. (7) "Ham Radio Aug. (8) "QST" Oct. All 1971.—VK3ASC.

Antennas: 1, "A New Slant to a Tilt-Over Tower", "Notes on the Cubical Quad Antenna"; 4, "Convert your 7 MHz. Cubical Quad to All-Bands", "The Indoor Quad"; 5, "A Low-Cost Tilt-Over Tower", "Radiated Power Patterns for Multiband Dipoles"; 6, "A 5 over 5 Stacked Yagi Array for 50 MHz", "A Forty Metre DDRR Antenna"; 12, "How to fit a Rotating Mast in a Tower".

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VHF/UHF/Microwaves: 2, "VHF Co-ordination Committee Report, including ZL 144 MHz. Band Plan"; 4, "73" tests the "Gladding 25 FM Transceiver"; 6, "Some Thoughts about 220 MHz. Operation", "Using the ATS-1 Weather Satellite for Communications"; 7, "Just Look at the Weather" Part 1, the reception of automatic picture transmissions from satellites; 8, Part 2 of above, "So you can't afford a Receiver" (straight forward Rx using old FM tuner); 8, "The G3EEZ 9 cm. Converter", "Microwaves, 1000 MHz. and up"; 9, "Push to Talk for a Styleline Telephone" (touchtone on translators), "High Power Line Amplifier for 220 MHz."; 10, "Digital Calibration-Spectrum Generator", "Improvements to the DC9MD Mini Walky-Talky", "Stripline for VHF and UHF", "Simple 70 cm. Transverter for Portable Equipment", "Stripline Bandpass Filter for 70 cm.", "A Simple Modulator for FM Transmitters", "A Transistorised Power Amplifier for two metres using the 2N3632", "Frequency Multiplication with High Spurious Signal Rejection".

KEY: 1, 2, 3: "Break-In"—Oct., Nov., Dec.
4: "73"—Dec.
5, 6: "QST"—Nov. Dec.
7, 8: "Radio Comm'cation"—Nov., Dec.
9: "Ham Radio"—Dec.
10: "VHF Communications"—Nov.
11, 12: "Radio ZS"—Oct., Nov.

All are 1971 issues.—VK3ASC.

DX

Contributing Editor: DON GRANTLEY,
P.O. Box 222, Penrith, N.S.W., 2750.
Times: G.M.T.

When compiling a page of this nature, one is often undecided as to just what is necessary and what can be omitted. I tend to omit news of future operations unless I have the information well in advance of the scheduled date, usually advance news comes with only a few weeks notice, and by the time it would reach the reader, the operation is over. QSL information, however, is of vital interest, particularly in view of the increased interest in the various award programmes now in operation by various clubs, societies and individuals. Most of these require the cards to be in possession of the applicant, and this is one reason why concentration on this phase of DX is given.

On the subject of QSLs, the poor return is often a subject of concern to the award hunter. I have a list of VK stations from whom OK-3CGP is awaiting calls. Knowing many of the people listed, I would say that they have sent their cards and these have been held up in the Bureau, but in case any reader has worked this chap and can assist him with a card, then he would be pleased to receive one via the Bureau. And whilst on the subject, I note in October "QST" that 9G1WW, whose policy it is to answer QSLs upon receipt, finds it difficult to do so through lack of information on the cards he has received. G-lander points out the fact that it is advisable to write the name of the month in full instead of using the numeral because of the different system used in various countries. For instance, 1/6/71 to us indicates the first of June, but to many countries including the U.S.A. it indicates the sixth of January. To a busy DX station or manager this takes time to sort out, and they just return them to the sender. Finally, on the subject of QSL returns, my highest percentage of incoming cards are from the JA and UA Bureaus.

One of our best known and most capable s.w.l's, Chas Thorpe of Rockhampton, who has been a member of the VK4 Division for many years, has just returned home after a spell in hospital where he underwent surgery. I am sure his many friends wish him a speedy return to health, and look forward to his return to full activity.

A very welcome note to hand from Lee VK-2AXK who has been around the DX bands for quite a while. He reports good conditions into Europe on 20 metres in the early morning, and worked ZS6GP/M, EQ2WB, VQ9R and 7Z3AB at around 1500z. Amongst stations he has worked around 1100z were VQ9WES whose manager is WA3OTV, HS0UDN, YB9UA/0 (Box 2761, Djakarta) and ZP5TT. Lee also lists VQ9R as Box 193, Mahe, Seychelles Is., and 7Z3AB as Box 2486, Dhahran, Saudi Arabia.

Jack VK3AXQ lists a number of stations worked, together with their QSL arrangements where possible. They are EQ2BQ who is normally EP2BQ, several VR2s using the new 3D prefix, YN1RSJ, VE1KG (Box 663, Halifax), C20ED (Box 32, Nauru), VP7DL who says QSL via R.S.G.B. or direct to call book address with 2 IRCs. Also VP2VAG (QSL to VE3GMT). Jack also advises me of the proposed TI9IJ operation by TI2IZ on 14th Feb.

George VK3ASV/T down in Morwell reports a very good opening on 10 metres when he worked several JAs, RA0ABE, RA5EDY, 9K2KI, DL6RK and HA5EG. Good going for 10 mx at this time of the cycle.

Special prefixes in use recently include C20 used by Nauru operators on national holidays (but see addendum.—Ed.) PJ0AT (manager W3RNQ), PJ8AA (manager W2BBK), and PJ9AD (manager W2VIA). WY3MCA was the special call used over the period Jan. 23-30 from Severna Park, Maryland, during Y.M.C.A. week. QSL details not available at this time. JD6EA will be the new call of KR8EA from Jan. 1, while JH6 prefixes are now on the air. 9H3B now active, QSL to VE3MR. 9H3WPD was a special station operating for World Peace Day on Jan. 1. Not a well publicised one was WB4TON, Hollywood Radio Club operations day Jan. 8, gave W4OZF as QSL handler with a special QSL for working the station on c.w. and s.s.b., and a special certificate for five-band operation of the station.

Two other special stations in the States were WM1NSA, QSLs for which go to Box 310, Boston, Mass., and WO8HIO from the Ohio State Fair, QSLs to WB8CWD. PE2EVO, Eloluon permanent exhibition station at Eindhoven is of interest to some. For five-band operation of this station, your QSL will be affixed to the honour roll at the exhibition provided you send them your QSLs, and receipt of their QSL entitles the holder to free admission to said exhibition.

Finally, VB1MSA is a new prefix of which I have no information. YB3AAY, YB9AAT and YB0AAH are all lined up for the prefix hunters, their managers being W3BRB, W4YUU and W5MVP. ZL1JAM early this month at the National Scout Jamboree, Sth. Auckland, cards go to ZL1BBH who will QSL 100% with a special card. I might add that this station was in great demand and these operations catering for such events should be aided and encouraged by all of us as a possible way to assist the youth of today in following a hobby which will be not only interesting, but more than beneficial in guiding them away from the more unsavoury pastimes which are being presented to them by unscrupulous sponsors.

Tanzania recently celebrated her 10th anniversary of Independence, the 5H5 prefix was used by Amateurs for this occasion and the QSLs for all using this prefix go to 5H3LV, Box 23169, Dar-es-Salaam, Tanzania.

There has been an increase in operations from YK, YK1AS is the training station for YK operators and is QRV on 14 c.w. YK1AA Rasheed, and YK1OK Jenda are most active; the latter, originally licensed for 80, 40 and 20 operation only, can be identified by a slightly chirpy signal, however she was due to go QRT at the beginning of March. QSL to YK Bureau.

Operation from Majuro Is., which counts only as KX6 Marshall Is. but as OC29 for IOTA chasers, is currently active by KX6NB, KX6NP and KC6CD/KX6 Rudolf Aliven, Box 285, Majuro Is., Marshall Is., 96960. Other K prefixes of possible interest which are at present active are KB6DA, active until end of Feb., manager is W6CUF; KZ5EK, QSL to DL1HH; KC6JC from the East Carolines, managers for Cav are W2GC and W2RDD, and last but not least, Swan Island is operational again, this time by W6MTE/KS4 who has been using 14035 c.w. and 14325 s.s.b., also 7001 c.w. He will have a KS4 call by the time this issue of "A.R." is released, and QSL data is not yet available.

SK7BK is the call of the Freebooters Radio Club who hold their QSO parties on the third Sunday in Jan. and Sept. on 3670 s.s.b., and the third Sunday in March on 14215 s.s.b. SK7BK uses the frequencies listed above, but the other club stations use 3700-3800, and 14230-300. The Freebooters statuette is given to all who work four members of the club plus the club station, during the party QSOs with up to two statuette holders (who are classed as honorary members) may be counted toward the award, but at other times it is necessary to work the club station first, and only SM7 members may be counted. March 19 is the date of the next party which is on 20.

Results of the 1971 "CQ" WPX s.s.b. Contest have been announced, no VK calls appear in the short list which I have here.

WA1ARF/KS4, through his QSL manager WA6MWG, wishes to make it known that the logs covering the period June 22 to July 21 were packed in Bob's trunk when he left the island and the QSLs for that period will be delayed until Bob mails them on from PJ land where he is at present.

This one has not appeared in the newssheets to my knowledge, but JT1AM has been booming in here regularly on Saturday evenings just inside the 20 metre band with a 599 signal. He has been swamping the band at times, and not getting too many takers other than an odd JA. This chap is a good operator and his transmitter does not have the poor T7 note which characterised the earlier JT stations. He gave the normal QSL address, Box 639, Ulan Bator.

YN0HSM is the call sign to be used by YN1HSM over the contest week-end of March 4-5, then during the WPX Contest on March 25-26 he will use HT0HSM. Freq. will be 7261 s.s.b. 0001-1300, 14276 s.s.b. 1300-2359. He asks for all QSLs via WA8TDY. Also on the air for the event will be YN0YN which is the official club station for the C.R.E.N. club which QSLs via Box 925, Managua.

Recent operation by ZD3Q now completed after over 6,500 QSOs, 579 on 80, 1266 on 40, 1643 on 20, 1862 on 15, and 1192 on 10, many stations being worked on all five bands. QSL mauager OZ3PO asks that contact do not get too impatient for their QSLs as there has been a delay with the printer, and they should be available by the end of Feb. or early March.

Some news from 5Z4. 5Z4MX QRV daily, and at week-ends on 14300 s.s.b. 1800, 21300 s.s.b. Sundays 2100 and on 28600 s.s.b. Saturdays and Sundays at 1500. His manager is DK3IR. 5Z4NM will have completed his operation by the end of Feb., he is DJ3YU and asks that cards be sent to his home QTH. 5Z4MO is currently active, having been noted on 3799 s.s.b. at 2014.

VE3GNM wishes to make it known that he is no longer manager for CR6CA due to the long delay in logs reaching him, cards should now be sent direct or via the CT Bureau.

If you worked 7Q7PAX during the 1968-69 period and have not yet had your contact confirmed, W3YEK/2 who was the operator for the period has the logs and will be pleased to confirm from his home address.

W3HNK has terminated his QSL handling for UD6, UF6, UG6, UL7 and UO5 regions, but can still assist with cards from UC2, UH8, UI8, UJ8, UK8 and UM8, also he handle all QSLs for Crete operation of SV0WEE for last Sept. I do not know just what his arrangement is in regards to the U.S.S.R. call areas listed above, but I suggest that an air letter to him before sending cards may be a good idea. QTH is J. Arcure, Jr., Box 14, Norwood, P.A., 19074.

Finally as far as DX is concerned, I will briefly give a rundown of other interesting DX currently active. BV2AB usually on with XW8AX, manager is K4ASI. CE9AR on from Deception Is. in the Sth. Shetland group, Julio CR4BC still causing an odd pileup when on, QSL to Box 36, Sao Vicente. CT2AO, manager WB4KVN. EA8GK will arrange skeds through manager K6GAK, XT2AE QRV 21210 s.s.b. Sundays 1000 and 14170 Fridays at 1700, breakers to wait until after sked, manager is DJ9KR. 4W1AF skeds manager DJ9KR on Sundays at 0900, also QRV 14265 Fridays at 1530z.

A.R.R.L. QSL BUREAUS

There have been several important changes in the locations of several A.R.R.L. Area QSL Bureaus, namely the W4/K4, W8, W0, the latter now being split into three sections covering W0, WA0, K0, WB0, WN0. Minor address changes in W3, WA4, W9 and KZ5. I do not have room to list them all here, but they are in the Nov. issue of "QST".

My thanks this month to Amateurs and S.w.l's listed in the text of this page, and I acknowledge copy from the Geoff Watts DX News Sheet, and "QST," "73," and good hunting, de Don L2022.

ADDENDUM de H. R. Evertick: Visitor to Melbourne recently was David Costello, C2IDC, now returned to Nauru. David lists only four calls in use on Nauru at present as himself (s.s.b.), Bob Lear C21AA (VK2ASZ) on 20 s.s.b. and 6 mx, and VK3TL using calls C20ED as a school club call, and C29TL (on s.s.b.) as his own call.

NEW CALL SIGNS

NOVEMBER 1971

The Publications Committee have decided to print only new call signs henceforth. The following is the first list, November, 1971. Note that VK1 and VK2 cover the period from September to November, 1971.

VK1GM—G. M. Percival, 18 Weld St., Yarralumla, 2600.
VK1GT—W. E. Tiller, 23 Carrington St., Deakin, 2600.
VK1MS—M. S. Stark, 17 Clisby Close, Cook, 2614.
VK1RA—R. A. Angrave, 10 Nicholas St., Higgins, 2615.
VK1VN—V. H. Norrish, 21 Carruthers St., Curtin, 2605.

VK2II—J. L. Martin, 37 Elimatta Rd., Mona Vale, 2103.
VK2JN—J. F. Barker, 51 Beale St., Georges Hall, 2198.
VK2RR—D. E. Krull, 2/43A Grand Ave., Westmead, 2145.
VK2WN—A. S. G. Fenton, 26 Muttama Rd., Artarmon, 2064.
VK2ZI—F. Bridgewater, 31 William St., Broken Hill, 2880.
VK2AJF—J. B. Dennis, 246 Wollongong Rd., Arncliffe, 2205.
VK2ALH—A. L. H. Bennett, 21 Monterey Rd., Bilgola Heights, 2107.
VK2AOZ—L. H. Ferris, 12 Toomevara St., Kogarah, 2217.
VK2ARM—R. S. McEvoy, 61 Tuffy Ave., Sans Souci, 2219.
VK2AUP—R. J. McHardie, 21 Oldfield St., Warilla, 2528.
VK2BBE—N. E. V. Quinn, 639 Hodge St., Albury, 2604.
VK2BBX—L. R. Carter, 31 Fairfowl St., Dulwich Hill, 2203.
VK2BDT—D. S. Thompson, "Glenelg," Golspie, 2580.
VK2BFI—J. H. Ginsberg, 1/282 Belmore Rd., Riverwood, 2210.
VK2BII—E. W. Cleburne, "Cuttagee House," Bega Rd., Bermagui South, 2547.
VK2BLZ—L. L. G. Meek, 47 Turner Rd., Berowra, 2081.
VK2BNJ—C. B. Murphy, 21 Nicholson St., Kempsey South, 2440.
VK2BOE—S. R. Hutchinson, Y.M.C.A., 325 Pitt St., Sydney, 2000.
VK2BQQ—K. Nad, 1/21 Lavender St., North Sydney, 2060.
VK2BRX—P. W. McNabb, 1 Bellevue Cres., Cardiff, 2285.
VK2BRZ—S. J. Rigney, 152 McKay St., Nowra, 2540.
VK2BWJ—G. Wood, 11 Clarice St., Lithgow, 2790.
VK2ZAY—B. J. Harwood, 38 Dalton St., Boggabri, 2382.
VK2ZCF—T. R. Harris, A.E.M.S. Radio, 2AD R.A.A.F., Richmond, 2755.
VK2ZFF—S. J. Blair, 17 Deborah Pl., Eastwood, 2122.
VK2ZKK—G. Rosam, 33 Cheshire St., Berkeley, 2506.
VK2ZOF—G. D. J. Barrett, 45 The Causeway, Maroubra, 2035.
VK2ZOG—W. J. Arnott, 176 Michael St., Jesmond, 2299.
VK2ZOI/T—J. C. Bishop, 153A Galston Rd., Hornsby Heights, 2077.
VK2ZOJ—G. N. Brown, 141 Rae Cres., Kotara, 2288.
VK2ZOM—G. J. Gillam, 20 Mt. Keira Rd., West Wollongong, 2500.
VK2ZOP—E. C. Brockbank, 4 Lynette Pl., Kotara, 2288.
VK2ZOQ—I. G. Repin, 24 Bennelong Cres., Bellevue Hill, 2023.
VK2ZOS—K. J. Scully, 179 Denison St., Hamilton, 2303.
VK2ZPU—G. J. Gray, 42 Gould Ave., Petersham, 2049.
VK2ZQK—R. A. Evans, 17 Burbar Ave., Kirrawee, 2232.
VK2ZQO—W. G. Kennedy, 7 Bass St., Kingsford, 2032.
VK2ZQP—C. J. Humby, 851 Squadron R.A.N. A.S., Nowra, 2540.
VK2ZTB—R. L. Harrison, 1 Huntleys Pt. Rd., Huntleys Pt., 2111.
VK2ZTE—G. D. Tickner, 34 Lowry St., Cardiff, 2285.
VK2ZTZ—R. J. Rodrick, 8/23 Orpington St., Ashfield, 2131.
VK2ZUS—G. W. Francis, 53 Falconner St., West Ryde, 2114.
VK2ZUV—P. J. Mason, 11 Villowra St., Auburn, 2144.
VK2ZUZ—C. J. Minahan, 5/23 Bridge St., Waratah, 2298.
VK2ZWA—R. W. Wood, 17 Kennedy St., Rutherford, 2320.
VK2ZWP—R. R. Black, 62 Auburn St., Sutherland, 2232.
VK2ZXX—D. G. Swan, 38 Finlayson St., Lane Cove, 2066.
VK2ZYG—W. J. Collison, 20 Fotheringham St., Wingham, 2429.
VK2ZYH—H. Ruessel, 38 Engadine Ave., Engadine, 2233.
VK2ZYI—K. E. Curle, 24 Beach Dr., Woonona, 2517.
VK2ZYJ—L. J. Grant, 19 Reif St., Parkes, 2870.
VK2ZZA—M. E. Johnson, 11 The Lee, Castlecrag, 2068.
VK2ZZC—D. A. Griffiths, 130 Stewart Ave., Hamilton South, 2303.
VK2ZZE—D. N. Kinny, 4 Scenic Cres., Kyle Bay, 2221.
VK2ZZF—N. A. Jays, 27 Grover Ave., Cromer, 2099.
VK2ZZG—G. T. Urquhart, 338 Mowbray Rd., Chatswood, 2067.
VK2ZZH—H. E. Wiltshire, 30 The Expressway, Albion Park, 2527.
VK2ZZK—N. Lean, 3 Eight St., Boolaroo, 2284.
VK2ZZL—G. L. Thorpe, 185 Park Ave., Kotara, 2288.
VK2ZZT—R. J. Swallow, 1 Chauvel St., North Ryde, 2113.
VK2ZYE—D. J. Longmore, 28 Spring St., Wagga Wagga, 2650.

VK3XS—K. V. Brayshaw, 89 Roslyn St., Burwood, 3125.
VK3ZB—I. W. Jay, 80 Grandview Gr., Rosanna, 3084.
VK3AEM—M. C. Elias, 20 Thoresby Gr., Ivanhoe, 3079.
VK3AJL—J. L. Wright, 72 Ramsden St., Clifton Hill, 3068.
VK3WIA/R4—Wireless Institute of Australia, Residence of G. L. Long, Eyre Rd., Mt. Dandenong, 3767.
VK3YGE—R. A. Morrison, 7 North Gateway, Werribee, 3030.
VK3YGF—P. N. George, Lot 1, Middle Rd., Pearcedale, 3912.
VK3YGI—E. G. Allchin, 26 Ashby St., Trafalgar, 3824.
VK3YGJ—H. R. Hardy, 1 White Pde., Churchill, 3842.
VK3ZEM—J. K. Ralph, 2/24 George St., Reservoir, 3073.
VK3ZHD—D. R. Hurley, 6 Abercrombie St., Balwyn, 3103.
VK3ZHL—B. R. Bathols, 3 Connewarra Ave., Aspendale, 3195.
VK3ZNQ—M. T. Joiner, 6 Pohlman St., Romsey, 3434.
VK3ZRD—D. S. Fisher, 9 Birdwood St., Box Hill, 3128.
VK3ZUN—R. E. Sherlock, 429 Princes Highway, Morwell, 3840.

VK4CY—C. W. McCamley, Main Rd., Maroochydore, 4558.
VK4JZ—L. F. Schmidt, Station: 28 Major St., Roma, 4455; Postal: P.O. Box 403, Roma, 4455.
VK4VU—R. M. Luther, 74 Mornington St., Alderley, 4051.
VK4VV—L. L. Luther, 74 Mornington St., Alderley, 4051.
VK4CAW—K. P. Warchot, Station: 1 Chester St., Thursday Island, 4875; Postal: P.O. Box 132, Thursday Island, 4875.
VK4ZAD—R. A. Elliott, 306 Bennetts Rd., Norman Park, 4170.
VK4ZBM—R. G. Blackmur, 35 Palm Ave., Holland Park, 4121.
VK4ZGK—G. C. King, 149 Park Ave., Eagle Junction, 4011.
VK4ZJZ—J. B. Grimes, Wirra, Banana, 4715.
VK4ZNW—N. J. Walden, 8 Kruger St., Booval, 4304.
VK4ZWO—T. W. Mitchell, 4 Thurso St., North Booval, 4304.
VK4ZWT—T. P. Walters, 11 Violet St., Toowoomba, 4350.

VK5IR—O. A. Isaachsen, 24 Seafield Ave., Kingswood, 5062.
VK5TH—T. R. Hutchesson, 45 Swallow Dr., Mt. Gambier, 5290.
VK5XQ—M. L. Parnell, C/o. Superintendent, Radio Branch, 30 Flinders St., Adelaide, 5000.
VK5ZAC—A. C. Gordon, 56 Euston Tce., West Croydon, 5008.
VK5ZGZ—R. W. Pitcher, 65 McKenzie Ave., Seaton, 5023.
VK5ZHT—H. G. Tremethick, 162 Winston Ave., Edwardstown, 5039.
VK5ZKT—I. H. Laughton, 8 Methuen St., Prospect, 5082.
VK5ZMB—M. J. Bloodworth, 16 Pamela Dr., Para Hills, 5096.

VK6EJ—E. J. R. Cowles, 10 Harrison St., Bluff Point, 6530.
VK6EN—J. Wippo, 1 Yalberee St., Newman, 6753.
VK6CIL—P. H. Long, Station: Portable; Postal: 337 Stirling Hwy., Claremont, 6010.
VK7ZPH—P. N. Heckscher, 4 Huntley St., Montrose, 7010.
VK8FB—F. D. Baarda, 18 Phillip St., Fanny Bay, Darwin, 5790.
VK8ZZ—G. Heming, 82 Hartley St., Alice Springs, 5750.

VK9ZDT—D. Tangey, C/o. B.C.P. Power House, Loloho, Bougainville, N.G.

VK0KA—K. B. T. Andrews, Macquarie Island, Antarctica.
VK0ZVS—A. G. Le Grip, Macquarie Island, Antarctica.

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PREDICTION CHARTS: READY-READER

Based on I.P.S.D. Series P for March 1972. Times are local for first-named place. For further explanation please see DX Notes Nov. "A.R.," p. 21. Where no plus or minus hours are shown there is either a sharp peak or the ALF intrudes. VK4(T) represents Townsville, VK0 is Mawson.

28 MHz.:

VK5—KH6	(1230)
VK2—W6	1100
VK4(T)—KH6	—6 1300 +3

21 MHz.:

VK5—KH6	—6 1230 +7
VK2—G (S.P.)	—2 1900 +1
(L.P.)	1900
PY	—1 1000 +1
ZS6	—1 1600 +4
9G1 (S.P.)	1600–2100
	—2 1100 +1
(L.P.)	—2 0800 +5
	1800 +1
W6	—5 1100 +3
8P	—4 1230 +5
VE1	—2 0800 +3
VK3—W1	—2 0800 +2
VK6—G (S.P.)	—4 1800 +2
W1	—1 0700 +1
VK0	1700

14 MHz.:

VK5—KH6	—1 0330 +2
VK2—G (S.P.)	1700–0600
(L.P.)	—2 0700 +3
W6	0100–0600
	1300–2200
9G1 (S.P.)	0700–1200
(L.P.)	1700–2000
PY	0600–2300
VK6 (2F)	0700–2000
ZS6	—3 1600 +7
8P (S.P.)	1200–1800
	2100–2400
VK3—W1	2200–0300
VK8 (2F)	—6 1400 +6
VK6—G (S.P.)	1900–0400
W1	2000–0800
VK0	—8 1700 +4

7 MHz.:

VK5—KH6	1730–0230
VK3—W1	—3 2200 +2
VK2—G (S.P.)	—3 0400 +3
W6	1700–0100
9G1	—2 0500 +2
ZS6	—3 0400 +3
8P	—2 1900 +2
VK8	1900–0600
VK6—G (S.P.)	—4 0400 +3
W1	—1 1900 +2
VK0	2000–0700

VHF

Contributing Editor: ERIC JAMIESON, VK5LP,
Forreston, South Australia, 5233.
Closing date for copy 30th of month.
Times: E.A.S.T.

AMATEUR BAND BEACONS

VK0	52.525	VK0MX, Mawson.
	52.100	VK0ZVS, Macquarie Island.
	53.839	VK0PF, Casey.
VK3	144.700	VK3VE, Vermont.
	144.925	VK3ZQC, Moe South.
VK4	52.400	VK4WI/2, Townsville.
	144.390	VK4VV, near Towoomba.
VK5	53.000	VK5VF, Mt. Lofty.
	144.800	VK5VF, Mt. Lofty.
VK6	52.006	VK6VF, Bickley.
	52.900	VK6TS, Carnarvon.
	52.950	VK6VE, Mt. Barker.
	144.500	VK6VE, Mt. Barker.
	145.010	VK6VE, Bickley.
VK7	144.900	VK7VF, Devonport.
VK9	144.600	VK9XI, Christmas Islan.
ZL1	145.100	ZL1VHF, Auckland.
ZL2	145.200	ZL2VHF, Wellington.
ZL3	145.300	ZL3VHF, Christchurch.
ZL4	145.400	ZL4VHF, Dunedin.
JA	52.500	JA1IGY, Japan.
W	50.091	WB6KAP, U.S.A.
KH6	50.101	KH6EQI, Hawaii.
	50.015	KH6ERU, Hawaii.
HL	50.100	HL9WI, South Korea.
ZK	50.100	ZK1AA, Cook Island.

A few changes to the beacon list this month. Firstly, the VK0 beacons should be treated with caution. It is unlikely any of these are operating on a permanent basis, and with Phil VK0PF returned to Australia at the end of January, nothing is known of the future of his station. Further interest in the Antarctic area will come with the next DX season at the end of this year, and renewed activity will no doubt see some contacts between VK and VK0.

A new beacon has appeared in Victoria, this time in the Eastern Zone, being VK3ZQC on 144.925 at Moe South. The new call sign will be advised when received. It is understood the VK4VV beacon is still off the air during alterations to the keyer to accommodate a new call sign. While still dealing with those beacons, perhaps of doubtful operation for various reasons, if someone reads these notes in Carnarvon, W.A., and on Christmas Island, could a letter be sent to me advising if VK9XI and VK6TS are still operational please.

As these notes are being written the DX openings on 6 metres are becoming fewer, but at least they will give some operators a chance to relax. I mentioned last month what a great season it had been this year, and with the increasing use of s.s.b. and transceive techniques contacts will become more readily available under marginal conditions. It really does make a difference if you know the other fellow is on your frequency, and as such operation extends in greater numbers to 2 metres we will see more long haul DX on that band.

There has been quite an upsurge in the number of contacts made across the Southern Ocean to Albany on 2 metres. The 16th Jan. appears to have been one such occasion, when Trevor VK5ZTN in Mt. Gambier worked Aub VK6XY and Bob VK6BE with signals 5 x 5, later peaking to S9. Trevor also heard Stan VK6SS in Perth on c.w. at 519 and Leigh VK6WA heard at 5 x 6. These two latter stations did not hear anything from the East. Chris VK5MC at Millicent in the S.E. of S.A. also worked VK6XY and VK6BE and heard VK6WA. Subsequently Colin VK5DK in Mt. Gambier worked VK6BE on c.w. later. All this cannot be left to pass without mentioning Garry VK5ZK, who every now and again sneaks in a contact on 2 metres to the boys in Albany. Garry's intuition seems to tell him just when to come on the air, he takes a sample of what is offering, then wanders off to his pot plants!

All 2 metre activity certainly has not been confined to the Southern States. On 2nd Jan. 2 metres opened via Es to ZL2. Peter VK2TK and Doug VK2ZZI were portable in the Central West of N.S.W. for a VK2 V.h.f. Field Day. At about 1920 Peter heard N.b.f.m. signals from ZL2TGT. Both Peter and Doug worked him at good strength, also worked ZL3AR/2 and ZL4PF/2. Strangely, no Sydney stations worked ZL, although some of them, principally ZL3AR/2, were audible. Unsuccessful stations in Sydney at the time were VKs 2HO, 2ZRH, 2II, 2ZAC. Roger VK2ZRH was heard in ZL but apparently the ZL in question could not resolve s.s.b.! Roger also reports that during the ZL opening he heard a VK4 Z calling on two. While all this was going on, Rod VK2ZQJ was inside sipping lemonade and watching t.v., tch! tch! Thanks to Mike VK2II for the last two paragraphs.

No notes would be complete without a mention of 6 metre activity, and there has certainly been some. Further to my mention last month of the hearing of VK0ZVS by Ross VK4RO, Bob VK3AOT advises others who have subsequently heard signals from the South to be Bill VK3ZWF and Ken VK3ZNJ. On 6th Jan. what is believed to be the first ever 6 metre contact within Antarctica occurred when Phil VK0PF at Casey Base worked WB5DYJ/KC4 at McMurdo Sound, due south of New Zealand. The distance was 1,200 miles, and signal reports 559 both ways. Phil was also copied at S5 by UA1KAE/1 at a Russian base in Antarctica. The Russians are not authorised to transmit on 6 metres and a 2-way contact was not possible.

A letter is to hand from Stan ZL4MB indicating his interest in propagation, particularly on 52 MHz. The matter has been discussed with Geoff VK3AMK with a view to trying to get enough Amateurs on both sides of the Tasman to keep skeds on Saturdays and Sundays. Stan mentions times being considered at present are between 0930 and 1030 E.S.T., with ZLs transmitting on even multiples of five minutes and listening for VK transmissions on the odd multiples. Anyone interested in following up these thoughts could either write to Stan whose address is: S. E. Andrews, 14 Como St., Maori Hill, Dunedin, N.Z., or Geoff VK3AMK, or you can mention the matter to me. Stan further advises having found a very good hill, 1200 feet a.s.l. for future portable operations. Such operations, particularly during the DX season, represent probably one of our best chances to work ZL4 (and that includes me, I have been waiting for years for that call area!).

During a 6 metre contact recently with Ross VK4RO, I learnt the boys in Townsville are gradually getting back to normal following cyclone Althea. Bob VK4ZRG lost both antennas and received water damage. Ron VK4ZTK took his antenna down. Peter VK4QD, half way up Castle Hill, took a large share of the brunt of the cyclone and lost half his roof. Ross himself suffered virtually no damage, being 50 miles to the south at Ayr, although being without power for a period did not help the contents of his freezer and refrigerator, crammed full of Christmas goodies! Ross did remark on the excellence of the DX season and indicated he had had 380 plus contacts and his best seven days' score in the Ross Hull Contest came in excess of 3,000 points, that's pretty good scoring. He also mentioned JAs have been heard already on 28 MHz. at good strength and advises all to keep an ear on 52 MHz. during March and April at least for TE contacts.

EARLY WARNING FOR T.E.P.

The Ionospheric Prediction Service will be setting up an early warning system for trans-equatorial-propagation (T.E.P.) during the March-April equinox of 1972. From mid-March to mid-April warnings of increasing maximum observable frequencies, range spreading, etc., via F2 on various Australia-Japan circuits will be relayed on the I.P.S. h.f. net on 6815 kHz. upper s.s.b. I.P.S. expect to be able to give approx. half an hour's notice of evening type T.E.P. for Eastern States and approx. ¾ hour's notice for Central and Western States. Warnings will also be given of any likely extensions of T.E.P. further south via Es. (Thanks, Mike VK2II). So all you chaps with Amateur band receivers only had better get cracking and make yourself a converter to listen on 6815 kHz.

144 MHz. METEOR SCATTER

Rod VK2ZQJ and John VK5QZ for eight days from 27/12/71 to 3/1/72 conducted meteor scatter experiments on 144 MHz., distance 720 miles, commencing 0700 with the usual five-minute call and listen sequences. Roger VK2ZRH also took part. Apart from the usual pings, grunts, etc., some c.w. characters were heard, some with a definite ring about them, others of a "rattlly" sound. It was also believed definite evidence of some s.s.b. "grunts". Some of Rod's comments after the test period are worthy of passing on for your interest.

He believed the "rattlly" c.w. could have been f.s.k. He also believes continuous carrier transmissions should have been used at both ends initially to establish the circuit. Random pings are so short and as s.s.b. is about 80% silence anyway, ping recovery with s.s.b. would only be about 20% of the continuous carrier transmission recovery. Adelaide may be marginally too close for optimum M/S. 800 miles is suggested by a reference as a minimum. More r.f. power is needed in the circuit on 144 MHz. Requires a couple of sessions to get the ear organised!

Rod believes the experiments have been useful and rewarding in terms of appreciation of the problems involved, getting the feet wet, etc. Probably these would be the first organised skeds in VK for 144 MHz. M/S. Possibly as 1972 progresses others may become interested and thereby more substantial results obtained.

Rod's final paragraph is worth repeating: "After several months of 52 MHz. M/S and eight days of 144 MHz. M/S, seeing more and more s.s.b. on 52 MHz., and listening to DX s.s.b. ident. tapes, then as the man said—'v.h.f. bands never close, it is just that the operators go QRT'."

That's all for this month. Here is the closing thought: "It is easier to bear some abuse if I reflect, 'I do not deserve this reproach, but I do deserve others that have not been made'." 73, Eric VK5LP, the Voice in the Hills.

STOP PRESS.—At approx. 9 p.m., Monday, 7th Feb., during an opening on 144 MHz. between VK3 and VK7, a contact was made between Mac VK3YEO using a.m. and John VK7JV using s.s.b. John, being interested in s.s.t.v., mentioned that he had on tape various s.s.t.v. images to be used in setting up his monitor when finished. Very little effort was needed to persuade him to transmit a few frames which resulted in some of the best pictures ever received by VK3YEO who previously had done all his viewing on the h.f. net frequencies. This more or less confirms the opinion that v.h.f. bands without the problems of QRN and QRM are ideally suited to s.s.t.v. operation. Furthermore, is this a first on v.h.f.?

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the Publishers.

S.S.T.V. STANDARDS

Editor "A.R.," Dear Sir,

We strongly endorse the proposal of J. A. Wilson and A. H. McKibbin ("A.R.," Jan. '72) that temporary standards for s.s.t.v. be established in Australia immediately. However, we consider that it would be most inadvisable for Australia to adopt a 16.66 Hz. horizontal sweep rate in view of the fact that 15 Hz. is well established as the standard in North America. A horizontal sweep rate of 15 Hz., phase locked to the Australian mains, can be obtained by tripling from 50 Hz. to 150 Hz., followed by division by ten in an IC. Component-wise, this is no more complex than the divide by three used to derive 16.66 Hz. That is, the simplicity and timing stability proposed by Wilson and McKibbin can be equally well obtained at 15 Hz. from the Australian 50 Hz. mains. Since 98% of all countries employ either 50 or 60 Hz. power, the Amateur Service can easily achieve a world-wide standard for a mains-locked s.s.t.v. system by appropriate action now.

A single standard will have its most obvious technical benefit in simplifying the introduction of a long time constant, phase locked horizontal sweep in the receiver (i.e. a long persistence "fly wheel"). Since a mains-locked horizontal sweep at the transmitter is highly phase stable (better than 0.01% over an hour), the receiver can gain a considerable improvement in resolution and immunity to noise, QRM and drop-outs by being likewise phase stable. Thus having obtained sync. once, the receiver henceforth ignores the sync. information in the video signal. This immediately eliminates the sync. jitter (about 2-3% of the horizontal sweep) which is evident on even a good s.s.t.v. signal, or the completely spurious sync. pulse due to noise.

Since in such a system both the transmitter and receiver at the one station have equally stringent phase stability requirements, it is natural that they share the same time base generator. This obviously requires that both ends of a QSO use the same horizontal frequency. The advantages of locally phase locked reception will show up most clearly on DX s.s.t.v., and it is for this reason that it is important that regional differences of standard be avoided assiduously.

In view of the ease with which Australia could adopt the 15 Hz. standard, and in view of the future benefits that will accrue from a truely international standard, we strongly recommend that the 15 Hz. horizontal sweep rate, 120 line standard, be adopted throughout Australia.

—K. G. McCracken, VK3AXE.
J. G. Ables.

S.S.T.V.

Editor "A.R.," Dear Sir,

Please find enclosed list of 2-way s.s.t.v. stations worked at VK5MF using a K7YZZ flying spot scanner, just about as described by Louis Hutton and using one of three monitors built to date. One a tube job as described by Copthorne MacDonald in "QST," one as described by SM0BUO in "Radio Communication" (R.S.G.B.) modified in details, and another developed around a transistor version of Cop. MacDonald's tube monitor. The latter monitor contains about 34 transistors, 2 FETs, 2 unijunctions, and ten or so diodes, continuous raster.

Also there is under design a fairly neat solid state monitor showing promise, using noise immunity gates V and H, continuous raster, electromagnetic scanning, etc., by one of our local technicians.

At the moment here the continuous raster is favoured, but a perfected circuit has not been found for monitors.

I have not tried Mike Tallent's Mark I. or II. monitors here.

I enjoyed your "A.R." story of course and have had some starters to help in Adelaide.

—Alan C. Smythe, VK5MF.

[The list of 2-way s.s.t.v. contacts on 14 MHz. is not printed in full, but contains numerous Ws, ZLs, VEs, and several out of the ordinary s.s.t.v. QSOs as SM5RQ, 9Q5BG, 6Y5PB, XW8AW and HR2HH.—Ed.]

INTRUDERS

Editor "A.R.," Dear Sir,

Intruders are a continuing and increasing nuisance on Amateur frequencies.

The accepted procedure for their elimination involves, first, a positive and meaningful identification (often impossible). This is followed by a lengthy bureaucratic process of uncertain outcome involving both the P.M.G. authorities here then their counterpart in the country concerned—even assuming that the country is a signatory to the I.T.U. which frequently is not the case.

Therefore the suggestion of Alf VK3LC ("A.R.," Jan. '72) to form a "QRM Brigade" to call CQ on the intruder's frequency deserves close attention. Many may be sceptical of the effectiveness of the procedure. But we are assured by those who have tried it, even solo, that the method often works and the offending station moves off frequency to avoid QRM. An added attraction is that it affords emotional relief to the anger many feel against intruders on our bands. If effective, a vast bureaucratic obstacle may be neatly by-passed.

Here in VK7, Alf's suggestion has been widely discussed and we have Federal approval for our suggestion that the letters (or words) "IW" be included between each CQ. This has three advantages: (1) It clarifies the special meaning of the CQ; (2) It is an invitation for others to net on frequency and add their voices; (3) If widely adopted could be a deterrent to stations planning to operate on Amateur frequencies.

No objection will be made by the authorities to the employment of this procedure.

—Ian Pearson (VK7 Intruder Watch).

JUSTIFYING AN EXISTENCE

Editor "A.R.," Dear Sir,

Mr. Peter Williams, VK3IZ, in a letter to "A.R.," Jan. '72, points out that the most vital issue confronting Amateur Radio, is that of justifying our place in the spectrum. This should be our present concern and not Novice licensing. It is pointless, he says, pursuing the latter, until we have proven our case for retaining the bands we now possess.

No one would argue that our survival is of prime importance, but I disagree with the deduction re N.L.; in fact, I regard this part of his letter as unfortunate, as it is likely to create the type of thinking that would encourage those who desire to oust us from our present frequency slots. The reasoning of VK3IZ could be likened to a young married couple saying, "we will produce no children until their security can be assured." There is no such happy state as a guaranteed security, just as no sound case can be made out, to justify the existence of A.R,. ad infinitum, on the bands.

History shows that numerically fragile groups, particularly if they have little or no bargaining power, are usually the more easily disposed of, by larger antagonistic pressure groups. The R.S.L., Auto Associations, Trade Unions, etc., etc., all endeavour to increase membership, for obvious reasons. The permitted scope of our activity in Australia is restricted and it allows little or no lobbying power but there is strength in numbers. It must be remembered that we are in no way, a specialist group.

Numbers are also needed to deter the free-wheeling intruders, who illegally use our bands. A 10w. Novice won't have much impact but those who graduate to a full ticket, will. It is noticeable, that during contests, or other periods of high-level activity, these intruders mostly vanish.

There is yet another case for numbers. The societies of most countries have promotion programmes in order to increase their fraternity. To cite one example, figures for the U.S.S.R. are hard to come by, but it appears the Amateur population there is increasing rapidly, particularly clubs; so, why should we fall behind.

However, let's keep the subject in perspective. Survival in our A.R. global village is the constant concern for all societies in I.A.R.U. nations. N.L. is but a small fragmentary extension of conditions of licensing, in a relatively minor country.

It seems to me, that at future I.T.U's the A.R. case will be listened to more readily by the reps. of those countries whose governments tacitly approve of A.R. (U.S.A., Cent. and Latin America, etc.) and who consequently allow the Amateur to provide some community service, and third party traffic, phone patch, etc., etc.

In Australia, we enjoy no such status and the term "Amateur Radio Service" here is virtually a euphemism. We are, as the Minister for the P.M.G's Dept. described us, when announcing our last licence fee increase from the floor of the House of Representatives—**Hobbyists.**

Mr. Williams observes that A.R. needs a new set of values. I would agree that the opportunity to participate in community affairs, as is done U.S.A. style, would give us a new image here in Australia, but how can we demonstrate our value and service within the restricted framework of Hobbyists? I don't want to accuse VK3IZ of romanticism, because I share his idealism but would like to be told just what **new** values we might, in a practical sense, hope to attain.

A.R's activities are mainly to experiment and socialise. Our contribution in the latter is to spread international goodwill. To the cynics, I.G.W. is simply an empty cliche, that means little; DXing, they say, is the obsession. We are in reality, only a bunch of prefix-gatherers and any I.G.W. is incidental.

So we might ask the question, "Do our activities really promote I.G.W. and extend past the barriers of race, creed and class?" One way to answer or evaluate this would be to ask another question, "Would the world suddenly be poorer if international A.R. ceased overnight?" i.e. an end to all our on-air intercourse, all participation in community affairs, traffic, phone patch, etc. (where this is allowed) and a QRT to the daily exchange of a thousand technical and electronic ideas.

In a humble way the answer to both questions is a positive YES. (One can see this amply demonstrated by reading any copy of "World Radio".)

It is often said, "Why do we have to justify what is rightly ours? Are not the bounties of nature the rightful heritage of Mr. Private Citizen, for use, in part, for personal pleasure?" This means we should be able to enjoy part of the r.f. spectrum without having to establish a case. Be this as it may, the sad truth is that no justice is obtained unless it is fought for. It must be remembered, we live in a hostile world, where space for every human activity is at a premium.

Some of our activities are open to question. How does one answer this comment, "You blokes spend hours, even days, on this DX fun-kick, chasing a fragment of sand or rock somewhere, called a new country (sic), all for a 10 second QSO. That's as virtuous as collecting bottle tops. Can't you fellows put your time to better use?" It is true, that for some, this type of DX is a psychosomatic activity and only gives the critics a chance to be vocal. In my view, the whole framework of the DXCC "rat race" needs restructuring, with different incentives (too detailed to be outlined here).

At this present moment, the A.R.R.L. DX Advisory Committee is preparing a submission to hdq. which may result in the deletion, amendment or modification of DXCC status of non-administered rocks, reefs, islands. This overdue move has been the result of long and continued criticism of the value of this kind of activity.

The experimenters: The technical sophistication A.R. enjoys today is due to these purists and the sad truth is that as a group, they seldom get the merit and recognition they deserve. True, they experiment simply for the satisfaction it brings but as an incentive for thir talents, I feel the W.I.A. should make an award of generous proportions, to an individual or group, who yearly comes up with the best contribution. There is a rightful place for commercial gear: like other means of communication, it's here to stay but let's not forget the "back room" boys who will always have something of benefit to offer.

The v.h.f. scene: Reading U.S.A. magazines, I am impressed with the tremendous participation in community services by this group in the States; particularly in outdoor, beyond the line-of-sight, sporting events such as Air, Aero Club Races, Adventurers Club, Auto Road Racing, Marathon Foot Running, Bushwalkers, Yachting, Birdwatching, Swimathons, to name a few. Similar participation here in VK would do a lot for the image of the A.R.S.

It is easy but unwise to fall into pessimism when contemplating A.R's future. There will be change, this is certain, but no one can make firm predictions at this point of time. Even within the restricted confines of our conditions of licence in VK, we can and must do a lot better. This is the important thing.

—Alan Shawsmith, VK4SS.

DIVISIONAL NOTES

NEW SOUTH WALES

The January general meeting heard a very interesting lecture on the A.C.I. Electronics Acitron s.s.b. line of equipment. John VK3JE and Ken VK3AKK made the trip from Melbourne for this lecture.

Don Miller, VK2GN was re-elected as the VK2 Federal Councillor.

V.H.F. & T.V. GROUP MANAGEMENT COMMITTEE ELECTIONS, 1972

Charter: Para. 9 and 17. Nomination of a candidate for election to the Management Committee must be received by the Secretary in writing not less than 21 days before the Annual General Meeting of the Group with an intimation in writing that such candidate is willing to act. Each nomination shall be signed by two members proposing the candidate.

Notice is hereby given that the Annual General Meeting of the V.h.f. and T.v. Group shall be held on Friday, 7th April, 1972, at Wireless Institute Centre, 14 Atchison St., Crows Nest, commencing at 8 p.m. The business to be transacted shall be the Retirement of the Management Committee and the election of the Management Committee 1972-73. Notices of motion for the A.G.M. must be received by the Secretary not less than 21 days prior to the meeting and must be signed by at least three members.

—M. J. Farrell, Secretary.

ILLAWARRA BRANCH

Monthly Branch meetings of the Illawarra Branch recommenced on Monday, 14th Feb., 1972, at the Wollongong Town Hall. Future meetings should retain the interest of members as well as visitors by the monthly attendance of a guest speaker or a suitable film. Brian VK2ZGB, who arranges these segments of the meetings, has assured us of some interesting guests for 1972. Guest speaker for the March meeting will be Mr. Bob Milton, VK2ZMM, who has a vast experience in transmission feed systems and antenna design.

Wollongong's Ch. 1 repeater committee are still searching for a suitable permanent site for their repeater and are negotiating at the moment for a site between Heathcote and Wollongong. In the meantime activity through the repeater has been steady but consistent. The antenna system was scheduled to be changed to a four element beam on transmit and a 10 element beam on receive with the direction favouring the Sydney general area.

Barry VK2ZYL corrected the fault which had developed in the I.D. and has also lengthened the "trail" of noise which comes back when triggered. (VK2FE)

REPEATER AT TAMWORTH

The VK2 North-West V.h.f. Group (Tamworth) is in the process of preparing a repeater application for their area. It is a Channel 1 system to be located on Mt. Kopator.

VICTORIA

This month the Eastern Zone will be holding their Convention at Moondarra Dam, near Moe, on 18th and 19th March. Accommodation and meals will be provided by a hostel at the Dam. This area is excellent for a convention and an interesting week-end is promised.

DX operators in this State will be pleased to hear that they can send overseas QSL cards via the Bureau free from the 1st of July. This was agreed upon at a recent Divisional Council meeting as an added service to members.

Due to the large number of enrolments for the A.O.C.P. classes, it has become necessary to provide an additional class each week.

The V.h.f. Group will be holding a Convention at Wandin East on 1st and 2nd April, during the Easter holidays. The convention will have an interesting programme including a 2 mx antenna gain contest along with scrambles on all v.h.f. bands and 2 mx hidden tx hunts. For the benefit of h.f. operators, an 80 mx fox hunt will also be conducted. The builders of carphones will be able to see who has the most efficient rig in the mobile efficiency contest. The venue at Wandin East is in a very pretty area just behind the Dandenongs and is approx. 32 miles from Melbourne, 73, Gil VK3AUI.

SOUTH AUSTRALIA

The Dec. Christmas Social meeting had its share of Interstate visitors and many of them remarked how much more lively were their own breakups. I wonder if this should be a hint for the 1972 Council to act upon! The V.h.f. Section meeting was a display of members' equipment, old and new, and produced a varied and impressive display from Eric VK5LP's first home-built receiver used as s.w.l. to tune the world, to his latest sophistication. Four v.h.f. s.s.b. transverters showed the trend in this line too.

The V.h.f. Section field day on Dec. 5 resulted in impressive scores based on mileage, because of good 2 mx conditions to VK3 and a 6 mx band opening to VK6. Results (co-op. in brackets): VK5ZDX/5 (VK5LP), 33,848 pts.; VK5BW/5 (VK5WV), 25,745; VK5QZ/5 (VK5ZWW), 20,822; VK5PP/5 (VKs 5ZGJ, 5ZAG), 14,258; VK5ZCR/5 3,874; VK5ZT 3,096; and VK5QH 332.

Shifting the day to December certainly improved the scores, but more participation is needed. The John Moyle N.F.D. will have seen a massive VK5AWI club station effort on all bands.

Rick VK5ZFQ put on a good lecture at short notice about a circuit to display five transistor parameters on a c.r.t. at the January Divisional meeting. This caused a great deal of interest and should result in a journal article at least.

The January V.h.f. Section gathering was a barbecue at the home of Bart VK5GZ. A rainstorm almost drowned proceedings, but could not dampen the enthusiasm.

The building committee's report suggested a building in Thebarton could be available. If so, a permanent home for VK5WI may be accomplished at long last, after an option had lapsed, and renovations completed. This result of a second option on a building is a very fine reward for a hardworking group, and we all hope it will be successful. 73, Bart VK5GZ.

EVENTS CALENDAR

Mar. 9—VK4 General Meeting.

Mar. 18/19—VK3 Eastern Zone Convention, near Moe.

Mar. 18—VK7 A.G.M. and Dinner, Hobart.

Mar. 21—VK6 General Meeting.

Mar. 24—VK2 A.G.M. at 14 Atchison St., Crows Nest at 7.45 p.m. Election of new Council.

Mar. 25—VK2 Annual Dinner, Artarmon B.C. (Tickets $5.00 a double). Details from Sec.

Mar. 26—VK2 Field Day. Details Div. B/C.

Mar. 28—VK5 Divisional meeting.

Mar. 31-Apr 3—Federal Convention, Melbourne.

Easter—VK2 Urunga Convention. Details B/C.

Apr. 1/2—VK3 V.h.f. Group Convention, at Wandin East.

Apr. 7—VK2 A.G.M. and election of V.h.f. Group.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:—

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
1446	HL9WI	1458	AX3KS	1469	VE7BNE/W6
1447	AX3AXJ	1459	AX3XB	1470	AX7MK
1448	F8IH	1460	AX2XS	1471	AX4ZQ
1449	VE3HJ	1461	AX4LW	1472	AX5HW
1450	K2JMY	1462	AX1JL	1473	KG6JAJ
1451	K6UXV	1463	DL2RR	1474	AX3AFW
1452	IT9GAI	1464	FO8BY	1475	ON4EB
1453	AX5NT	1465	JA1MRS	1476	YU1AFQ
1454	AX7NZ	1466	AX2BRU	1477	DJ4KD
1455	AX3JI	1467	HB9UD	1478	W3UH
1456	AX3AXV	1468	AX2AHL	1479	AX2XM
1457	K9PPY			1480	AX3ARM

VHF/UHF SECTION

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
33	AX2ZUB	36	AX3BDA	38	AX2ZFX
34	AX3YDP	37	AX5ZID	39	AX4ZHW
35	AX2ASZ			40	AX4ZEL

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I.P.S.D.: TRIAL WARNING SYSTEM

A letter from the I.P.S.D. advises that a V.H.F. and T.E.P. warning system will be tested for one month during the equinox for the period 14th March to 9th April inclusive.

Ionospheric summaries will be relayed over the I.P.S.D. network from Sydney every 15 minutes from 1600 to 2200 hours E.S.T. on 11.440 MHz. in the afternoon and 6.815 MHz. at night. Mondays are rest days and there will be no transmissions.

The material from I.P.S.D. unfortunately is too lengthy to reproduce in this issue but an attempt will be made to include details in future issues.

Wide publicity has been requested as well as collaboration by interested Amateurs. The tests are designed to be one more step towards a wider and more comprehensive service by I.P.S.D. to all radio wave users. Please refer to Feb. "A.R.," p. 16.

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VS5 LICENSING

There is very little trouble in obtaining a licence in Brunei. Write to Brunei Telecommunications Department (Bandar Seri Begawan), Brunei, with a copy of your current licence and Brunei $10 or U.S. $3.33. The local mains voltage is 230 volts a.c. and hotels cost $7.10 per day.

SILENT KEYS

It is with deep regret that we record the passing of:—

VK2RD—Reg Longworth
VK2AAW—Bill Richardson
VK2ATW—T. E. Whitfield
VK3UM—Major W. Mitchell
VK3ZE—Stan Beaton
VK4RB—R. J. V. Browne
VK4SA—S. J. Armstrong

PROJECT AUSTRALIS

OSCAR 6 LAUNCH IN JULY

In a letter to W.I.A.-Project Australis the Radio Amateur Satellite Corporation (Amsat) have advised that the Amsat-Oscar C (AO-C) satellite is planned for launch some time in July. Unfortunately, neither the Australis 144/435 MHz. repeater nor the DJ4ZC 435/144 MHz. repeater can be carried on this flight. Amsat's decision to fly only a 2m./10m. repeater on AO-C was taken reluctantly and was caused partly by a reduction in the weight available on the N.A.S.A. launch vehicle for the July flight and partly by technical problems which have caused delays in the completion of the Australian and German repeater packages.

George Long, VK3YDB, who is building the Australis repeater, reports that good progress is being made on the system, but a problem with low efficiency in the 435 MHz. transmitters is only now being overcome with the availability of new components from America. Extremely high efficiency is required because of the low power (about 6 watts) available to run the whole satellite from the solar cells which re-charge the batteries.

What Amsat now propose to do is to fly AO-C in July and to fly AO-B in the second half of 1973. AO-C will carry the Amsat 2m./10m. repeater which is a multiple-access linear system that receives uplink signals between 145.900 MHz. and 146.000 MHz., and re-transmits them between 29.550 and 29.450 MHz. on the downlink. Sideband inversion takes place in the translation process (i.e., upper-sideband becomes lower-sideband and vice versa). Approximately 100 watts p.e.p. will be required on 2m. to work through the repeater. For best results, s.s.b. or c.w. should be used. A description of equipment which should be used to work the repeater is printed in "A.R." of December 1971, page 14.

Listed below are the basic characteristics of the 2m./10m. Amsat linear repeater breadboard:

Input frequency: centered at 145.95 MHz.

Output frequency: centered at 29.5 MHz. (Note.—This represents a change from the previously announced frequency of 29.6 MHz. which turns out to be the national ten metre f.m. frequency in the U.S.A.)

Beacon frequency: 29.45 MHz. (same as Australis-Oscar 5).

Repeater bandwidth: measures 120 kHz. at 3 dB. down points, 150 kHz. at 6 dB. down, and 240 kHz. at 10 dB. down. This means that stations capable of operating with higher power than that normally required to operate through the repeater can operate further from the repeater centre frequency thereby avoiding QRM from other stations using the repeater. In other words, the usable bandwidth for high power stations is approx. 240 kHz.

Repeater output power: presently measures approximately 1.3w.; final goal is 2w. p.e.p.

Input sensitivity: approx. —100 dBm. (2 microvolts/meter) for full repeater output.

Ground station power required to operate through the repeater: 80w. of effective radiated power develops full output from the repeater, assuming a maximum distance to the satellite of 2,000 miles. An 8w. transmitter and 10 dB. gain antenna should be sufficient, or an 80w. transmitter and an omnidirectional antenna.

Antenna gain required for reception: 0 to 8 dB. A 10m. dipole or beam should give good results at a maximum distance to the satellite of 2,000 miles.

AO-C will also carry a Morse Code telemetry system, but the Australis r.t.t.y. telemetry unit will not be flown until AO-B, because of the reduced power and weight available on AO-C. A description of the Morse telemetry and how to decode it will appear in a later issue of "A.R." The satellite command system being built by Peter Hammer, VK3ZPI, to enable the various satellite systems to be turned on and off, will be flown on AO-C.

The AO-C satellite, to be called Oscar 6 after launch, is expected to be put into an orbit very similar to that achieved by Australis-Oscar 5. That is, a near-polar orbit at a height of about 930 miles. The orbit will be sun-synchronous so that the satellite will pass over Australia at about the same local time every day of the expected one-year operating life. This would mean that the orbits would travel south to north over Australia at about 3 p.m., north to south at about 3 a.m. It is planned to publish tables to allow easy tracking of AO-C in coming issues of "A.R." Assuming a satellite height of about 930 miles, contact through the satellite with Amateurs more than 2,500 miles away should be possible.

Present plans are that the AO-B satellite, to be launched next year, will carry the Australis 144/435 MHz. repeater in the 4-channel configuration, the DJ4ZC 435/144 MHz. repeater, the Amsat 2m/10m. repeater, the Morse and r.t.t.y. telemetry systems, and the Australis command systems. As both AO-C and AO-B should operate for at least 12 months each, the next two years look like being an exciting time for Amateur Radio satellite enthusiasts, and, with only 100w. e.r.p. needed to work the AO-C repeater, it will not be difficult to become an Amateur Radio satellite enthusiast, if you are not one already.

Technical data on Amsat satellite systems was derived from editions of the Amsat Newsletter. Readers with queries on the AO-C satellite should direct these to W.I.A., P.O. Box 67, East Melbourne, Vic., 3002, attention Project Australis.

HAMADS

Four lines FREE for members only.

See Jan. 1972 "A.R." page 23 for complete details.

FOR SALE

Box Hill, Vic.: Yaesu FL-100B SSB Transmitter, covers 80-10 mx, USB-LSB, VOX Pwr. Supply inbuilt. $150. VK3AQY QTHR. Ph. (03) 89-3715.

Ashfield, N.S.W.: 2 MHz. Block Filters, Type 3O57975, ex A.W.A. Carphones, $3.60 each. VK2AXJ, QTHR. Ph. (02) 798-9021.

Melbourne, Vic.: Panoramic Adaptor 455 kHz. input, Singer Metrics Model SB200. Brand new condx. $250. VK3IZ, Ph. (03) 848-5790, or B.H. 45-2615.

Bankstown, N.S.W.: One AR7A Receiver complete with Coil Boxes and Power Supply. $75 or nearest offer. Ring I. Ward, 149 The Avenue, Condell Park, Ph. (02) 70-1991 after 5 p.m.

Melbourne, Vic.: Yaesu FT200 Transceiver and P.S. complete, $300. FTV650 6 mx Transverter, wired for above, $110, or both $400. VK3AUN, QTHR, Ph. (03) 46-4200.

Sydney, N.S.W.: Heath SB300 Receiver, SB400 Transmitter, table top microphone, matching SWR meter, electronic keyer, and 24-hour digital clock. Receiver fitted with CW and SSB filters and new tubes. Receiver and Transmitter each have a linear master oscillator and full quartz crystal set. Frequency setting accuracy on both units better than 500 cycles on any band. The above cost over $1000 new. Will sell complete station $550. VK2BFE, QTHR, Ph. (02) 451-2923.

Greenacre, N.S.W.: MR20B, complete/working, R1, 146, R4, $80. MR6, complete/working, 52.525, $60. Transistorised STC MTR125-131, complete/working, 52.525, $100. Transistor P.S.U., suit FT200, $65. Pye 25w. AM Base, $30. S.T.C. Base FM, 50w. low band, $50. John Bennett, VK2AAL, QTHR, Ph. 709-6281.

WANTED

Brisbane, Qld.: Pre-1940 Morse Keys, home-brew or commercial. Any condition, shape or size, hand or "bug". Price, partics. to A. Shawsmith, VK4SS, QTHR.

Melbourne, Vic.: FTDX100. Price and condx to VK3LS, 5 Hillsyde Pde., Strathmore, Vic., 3041. Ph. (03) 379-3619.

Pt. Macquarie, N.S.W.: SSB Receiver, good order reputable manufacturer, full details to VK2AEB, QTHR.

Melbourne, Vic.: Cossor Model 1049 Double Beam CRO manual. Will buy, borrow or hire. VK3ZZG, QTHR, Ph. 795-2506 or bus. 541-3559.